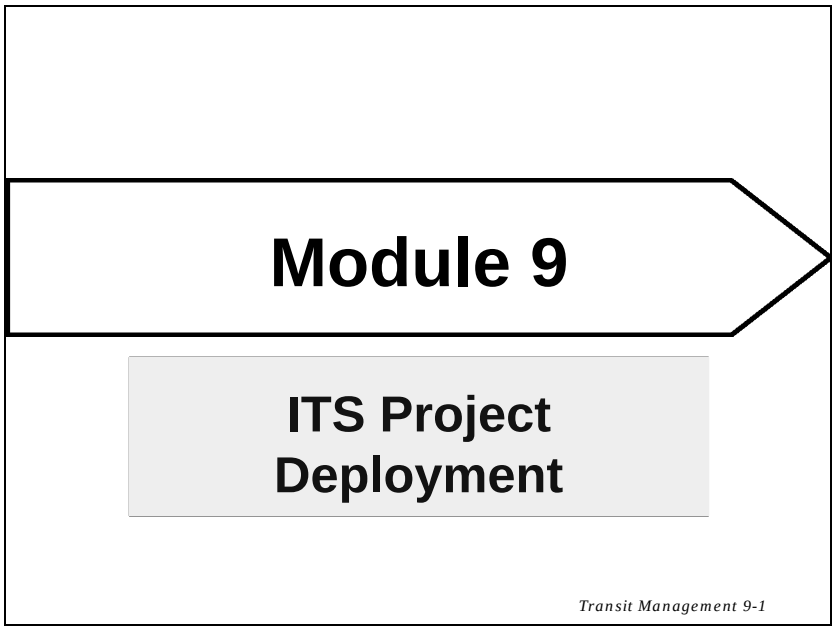
Module 9: Stages of ITS Project Deployment



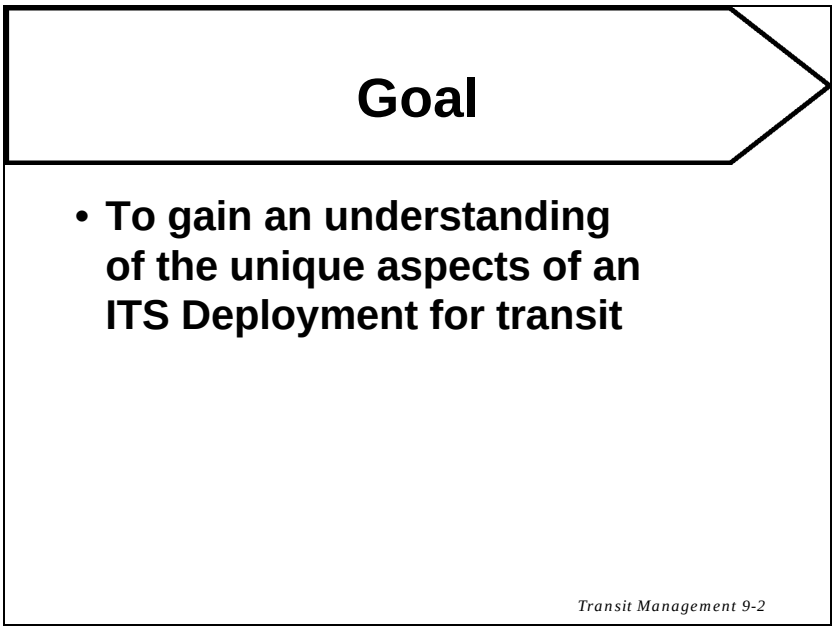
TRANSIT MANAGEMENT TRAINING ROADMAP	
	Module 1: Introduction to ITS and APTS
	Module 2: Automatic Vehicle Location Systems
	Module 3: Automated Transit Information
	Module 4: Transit Telecommunications
	Module 5: Transit Operations Software
	Module 6: Paratransit Computer-Aided Dispatch
	Module 7: Electronic Fare Payment
	Module 8: Technologies for Small Urban and Rural Transit Systems
	Module 9: Stages of ITS Project Deployment
	Module 10: What Can ITS Do for Me?

ITS Project Deployment

- Awareness
- Planning
- Design
- Procurement
- Installation/Acceptance
- Operations/Maintenance
- Evaluation

Introduction

Slide: Goal



Objectives

- Given a set of student materials, students will identify key individuals in their region or agency who may make excellent "ITS champions."
- Given a set of student materials, students will outline a preliminary plan for deploying a project with an ITS component in their agency, including considerations to make when staffing and training their agency.

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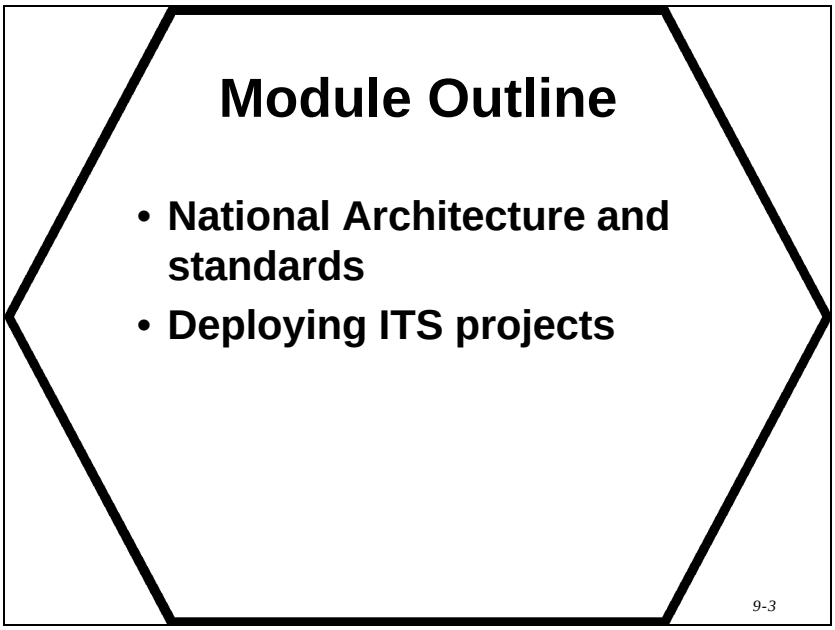
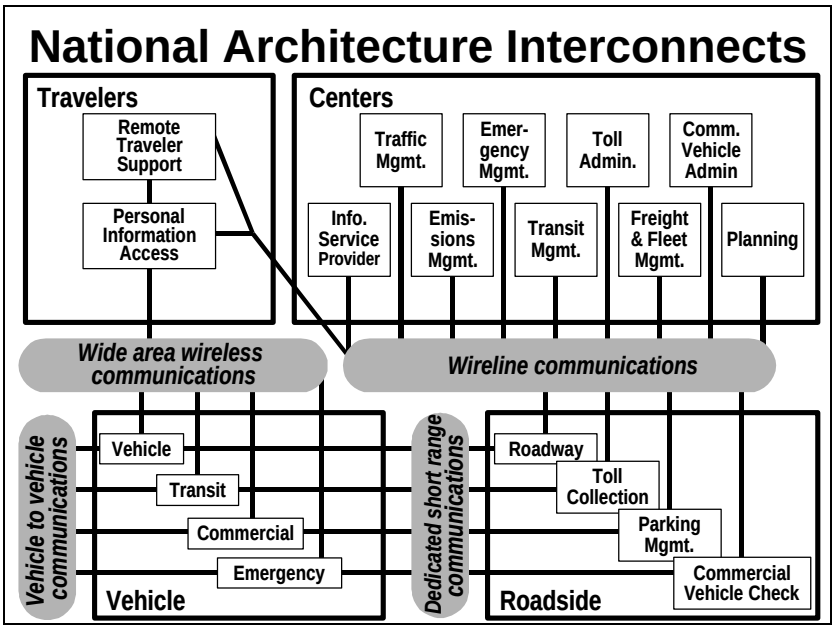
Introduction, Continued

Slide:
Module Outline



National ITS Architecture and Standards

Slide: National Architecture Interconnects



What is the National Architecture?

The National ITS Architecture is a master blueprint for building an integrated, multimodal, intelligent transportation system. It defines the functions that are needed for a common ITS infrastructure to be developed, while ensuring that local needs are met.

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National ITS Architecture and Standards, Continued

Interconnect diagram

This diagram is a high level view of the Architecture. It shows:

- groupings of subsystems that reflect real world entities in transportation:
  - ◊ Centers, Travelers, Vehicles, and Roadside systems
  - ◊ connections through various communications methods
- Nineteen subsystems of four categories are defined in the lower levels of detail in the Architecture.
  - ◊ e.g., Transit Management Subsystem => transit properties and management organizations
- Communications are the "S" in ITS. Ever increasing availability of communications, together with fast, cheap, and small computing technology, have combined to create an unprecedented opportunity for ITS development. Types of linkages advocated by the architecture include:
  - ◊ wide area wireless: (broadcast - like a car's radio receiver, or 2-way - like cell phones)
  - ◊ wireline communications: phone lines (voice or data)
  - ◊ dedicated short range communications: e.g., wireless vehicle tags for toll collection
  - ◊ vehicle-to-vehicle communications: e.g., collision avoidance (future) and improving vehicle control

National ITS Architecture

The National Architecture is a description of the functions needed to make ITS services possible. It:

- describes the activities involved
- describes the data to be passed between subsystems
- **does not** describe the technology to be used
- identifies interfaces between subsystems which will allow communication and information exchange
- is a set of tools to assist integration

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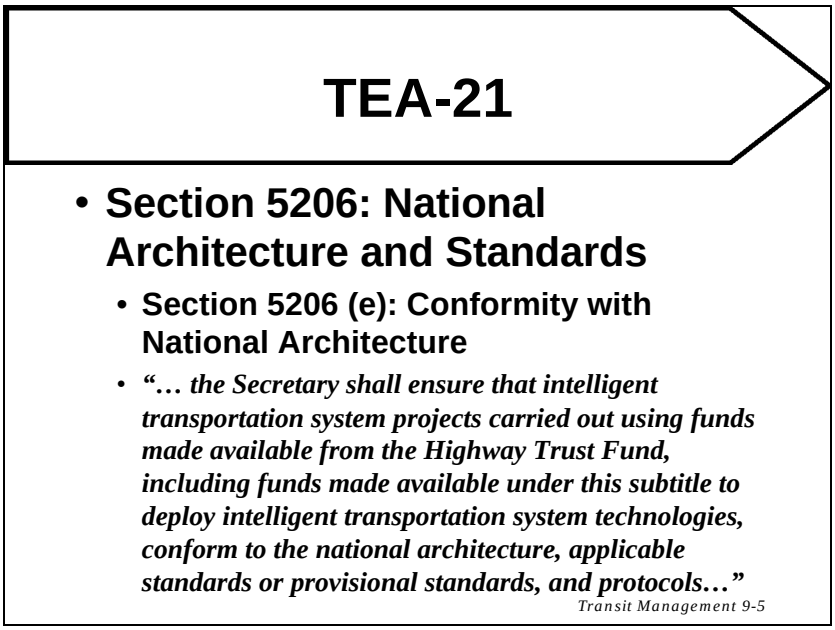
National ITS Architecture and Standards, Continued

Slide: TEA-21



Why use the National Architecture?

You should use the National Architecture as a starting point for your ITS projects because under TEA-21 legislation, all federally funded ITS projects must conform to the National ITS Architecture.

TEA-21

On June 9, 1998, the Transportation Equity Act for the 21st Century (TEA-21, Public Law 105-178) was signed into law, thereby reauthorizing the federal surface transportation program until the year 2003.

- "With the passage of TEA-21, the ITS program has fundamentally shifted from a program of research and development to one primarily focused on infrastructure deployment. More importantly, the direction from Congress is clear: technology will underpin the surface transportation system of tomorrow — and today. ITS has arrived!"
  ◊ Christine M. Johnson, Ph.D., Director, ITS Joint Program Office

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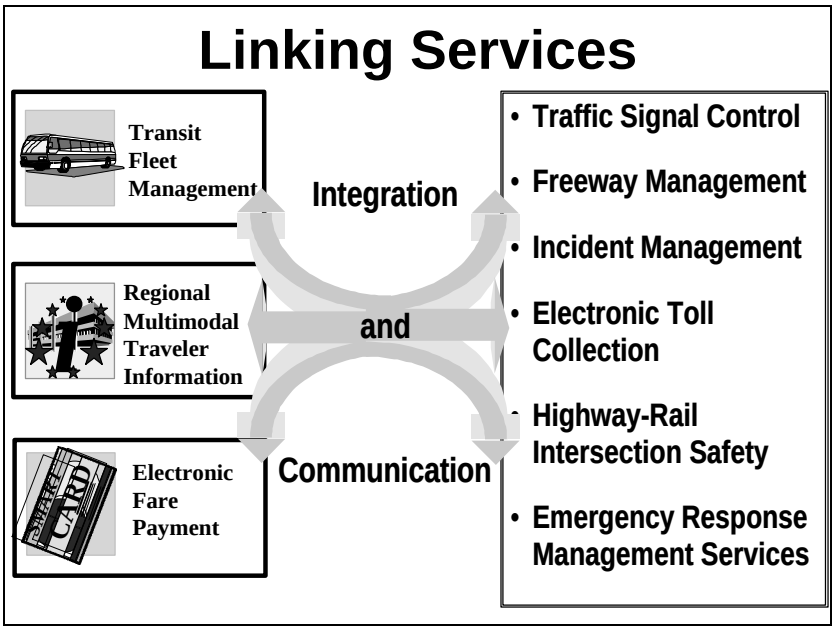
National ITS Architecture and Standards, Continued

Slide: Linking Services



Linking services

Even though APTS focuses on three of the Metropolitan ITS components, you still need to integrate all nine components and improve the communication networks for the efficient management of regional transportation.

Integration is the natural outcome of dependencies on similar technologies, operations and management by many of the same regional and local transportation agencies, and similar information and data flows.

The National ITS Architecture details this overlap and points of integration.

- ITS and APTS are working toward a **seamless** and **integrated** transportation system, rather than a "balanced" transportation system where the modes work separately.
- When integration & communication are key, the ultimate winner is the customer.

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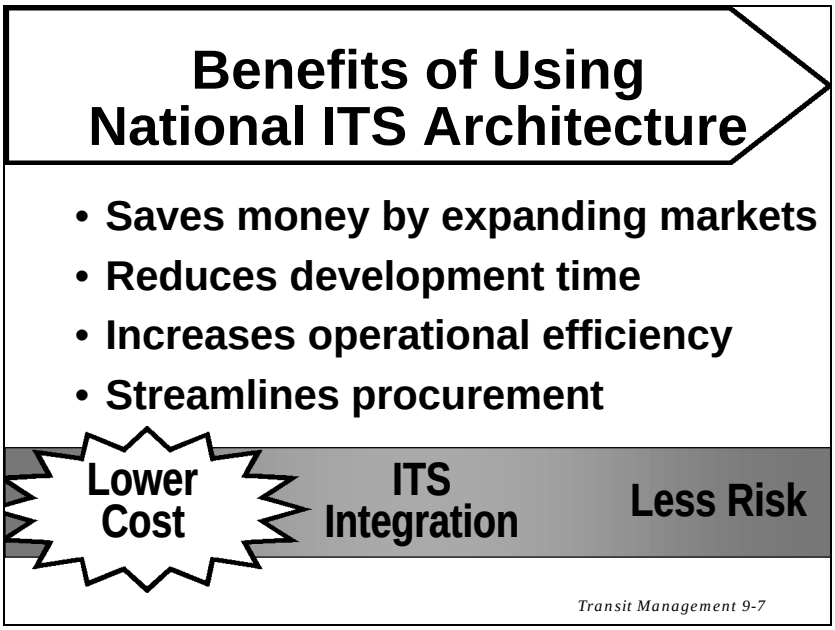
National ITS Architecture and Standards, Continued

Slide: Benefits Of Using National ITS Architecture



Saves money

Saves money:

- More vendors will be conforming and supplying compatible equipment, leading to competition and lower costs.
- More products will be "off the shelf" and will not have to be custom made.
- Open interface standards may result in an expanded market for ITS products and services, with resulting price competition and lower final costs.

Saves time

Saves time:

- The National ITS Architecture has already done most of the high-level ITS planning and system interface design for you.
  - ◊ It provides a large body of information to begin ITS development
  - ◊ It provides the basis for state and local ITS decision-makers to understand the potential ITS has for regional and statewide applications.
  - ◊ This can reduce development time for your projects by leveraging the existing analysis that has already been done.

Also, the National Architecture presents the structure around which standards can be developed, which in turn yields improved integration, e.g., better availability and sharing of traveler information.

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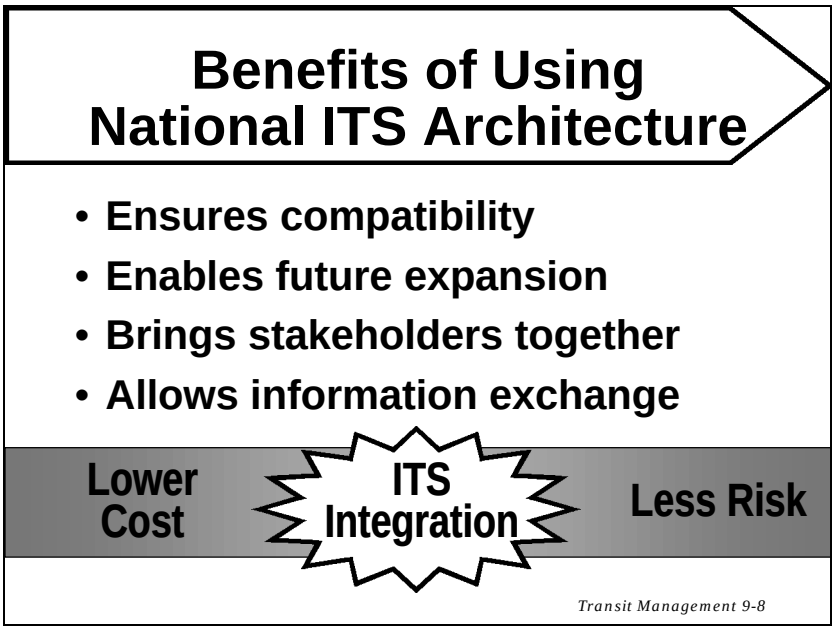
National ITS Architecture and Standards, Continued

Slide: Benefits of Using National ITS Architecture



Ensure compatibility

Future growth is enhanced by open standards being available:

- For state and local decision-makers, the National ITS Architecture minimizes the risks associated with buying individual components of an expensive transportation system.
- It provides a high level of confidence that future components will be technically compatible.
- The National Architecture enhances integration by defining the interfaces between subsystems.

Enable future expansion

Enables future expansion:

- Using the National ITS Architecture will allow designers to consider the technical requirements for future system expansion.
- In applying the National ITS Architecture at the regional and state levels, future transportation needs can be anticipated and planned.
- Even people who are only in the first stages of implementing ITS can consider future enhancements and know that system expansions will be easier and cost-effective.
  - ◊ The "open systems" approach allows an evolutionary development over a period of years to accommodate limited budgets.

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National ITS Architecture and Standards, Continued

Bring stake-holders together

When you implement a regionally significant ITS project, part of the recommended approach to showing conformity to TEA-21 is evidence that you have gathered all pertinent stakeholders together.

This is one of the keys to successful integration, and will help to spur regional integration.

- ITS will only be successful if all of the transportation stakeholders are involved in its planning and have bought into a long-range ITS vision.
- Applying the National ITS Architecture at the regional levels helps facilitate the inclusion of a broad range of stakeholders in the planning and implementation stages.

In addition, requirements in TEA-21 are spurring the development of regional architectures at the MPO level. Currently:
- Minnesota has a state architecture.
- Utah is developing a regional architecture.

Information exchange

The architecture leverages integration of transportation functions, information flows and technologies.
- By a comprehensive analysis of ITS user services, the architecture suggests desired interfaces to achieve a comprehensive range of ITS services.

In the long run, this will make exchange of information easier.

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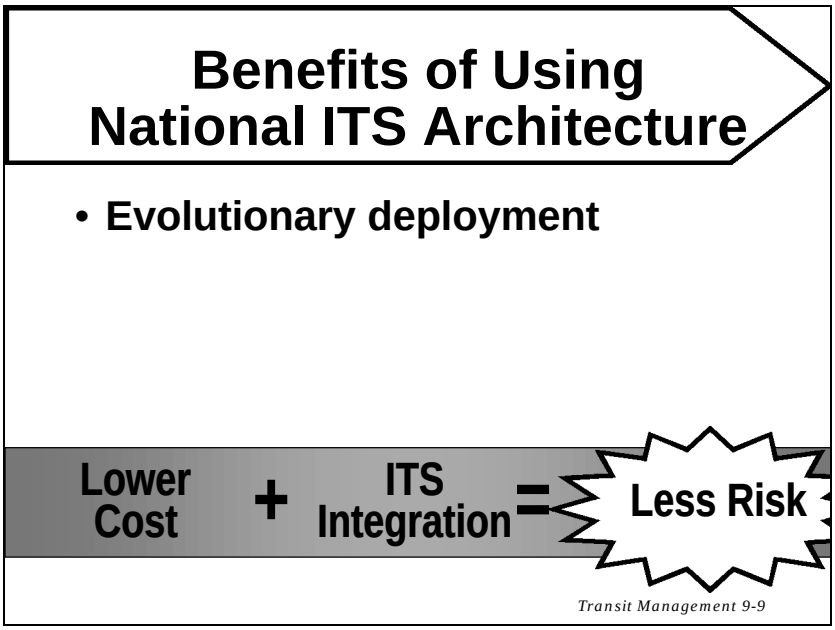
National ITS Architecture and Standards, Continued

Slide: Benefits of Using National ITS Architecture



Less Risk

The architecture minimizes risk through evolutionary deployment:

- By defining interfaces and institutional relationships, the architecture reduces risk.
  - ◊ Synergy: The methodology used in development of the architecture began with the functional requirements and then mapped common requirements into specific applications.
  - ◊ This allows developers to support a range of applications with similar functions and thereby serve larger potential markets with their products.
  - ◊ Deployment can be gradual with this approach.

- One of the fundamental guiding philosophies in the development of the National ITS Architecture has been to **leverage the existing and emerging** transportation and communication infrastructures in its design.
  - ◊ This minimizes the risk and cost of deployment, and maximizes marketplace acceptance, penetration, and early deployment.

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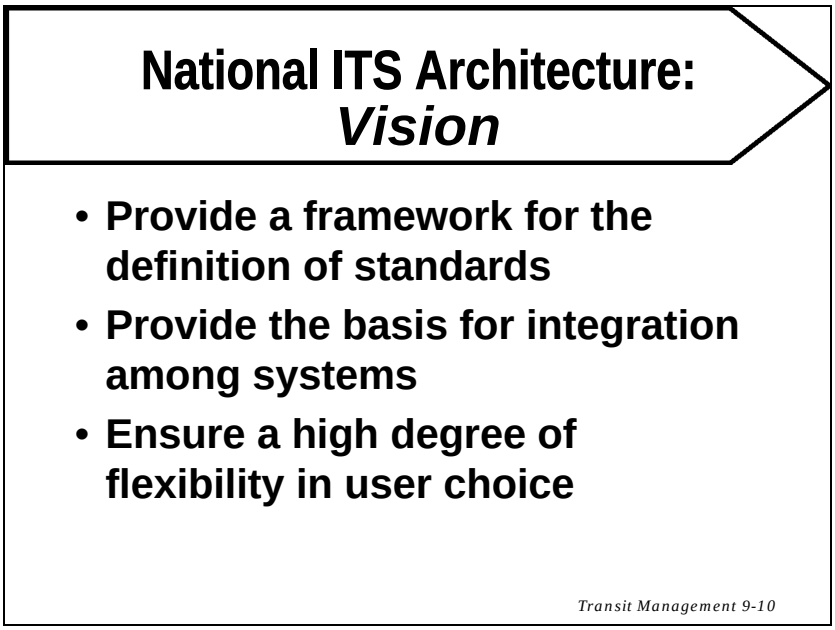
National ITS Architecture and Standards, Continued

Slide: National ITS Architecture: Vision



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National ITS Architecture and Standards, Continued

Vision

Source: The National ITS Architecture CD-ROM, Mission Definition Document.

3.1.2 Architecture Development Objectives

The ITS architecture defines an overall framework of integrated subsystems that can provide all of the services desired of the ITS. The objectives of this effort are as follows:

- **1. To provide a framework for the definition of appropriate standards.** These standards ensure national interoperability, so that vehicle equipment purchased anywhere will work throughout the nation. Standards increase the practicality of modularity in design and manufacture, and modularity based on appropriate standards permits the interchangeability both within and among subsystems. In turn, this allows greater competition among equipment suppliers and ensures that cities do not become captive to proprietary systems, and it also broadens their options for follow-on upgrading or expansion. It also permits volume production and lower costs.

- **2. To provide the basis for integration among subsystems.** This reduces the need for duplicate functions in different subsystems and thereby enhances reliability and reduces costs. This also ensures the use of common information sources among subsystems.

- **3. To ensure a high degree of flexibility in user choice.** Users can purchase only what they need, recognizing that they are dealing with building blocks that can support a wide range of implementation options without losing the advantages of integration and standards, or foreclosing the option for future upgrading and expansion.

The objective of the ITS architecture development effort is to create an integrated system architecture whose component subsystems satisfy the ITS architecture goals, ensure nationwide compatibility and interoperability, support the necessary range of implementations, and allow for cost-effective expansion and modernization.

For more information: the National ITS Architecture CD-ROM provides several evaluation documents that can help with your analysis, including *Cost Analysis, Performance and Benefits Study, Risk Analysis,* etc.

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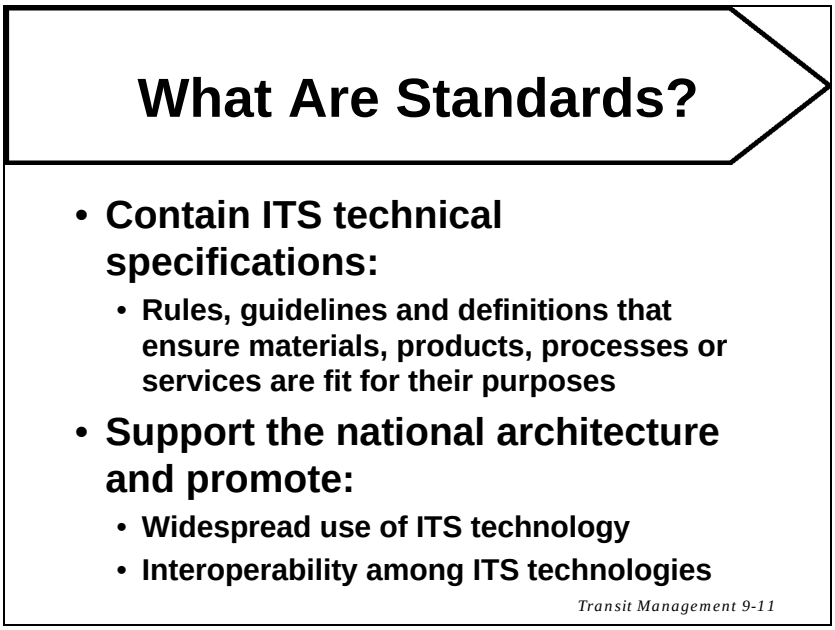
National ITS Architecture and Standards, Continued

Slide: What Are Standards?



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National ITS Architecture and Standards, Continued

What are standards?

Standards contain ITS technical specifications:

- Standards and protocols, together called "standards," define how system components interconnect & interact within an overall framework (the architecture).
- Standards specify how various technologies, products, and components must perform when used in combination or interchanged.
  - ◊ e.g., standards enable phone systems in various countries to transmit and receive voice signals.
  - ◊ Protocols, which define how data are to be exchanged, cover addressing, security, priority, and other data handling information.
- Standards are "open" if published for use on a non-discriminatory, competitively neutral basis, thereby enabling open competition among interchangeable products.
  - ◊ This prevents agencies from being limited to using a particular vendor for ITS upgrades and enhancements.
  - ◊ *e.g., open TV standards allow TV sets with different capabilities made by many different manufacturers for the last 50 years to use common broadcast signals.*

Standards support the National Architecture:

- The architecture structure is a means through which relatively independent standards activities can proceed with harmonious results.
- Because the standards will be developed based on the architecture interfaces and data flows, information that cuts across standards activities is identified.
  - ◊ This allows standards organizations to be aware of overlapping activities.
  - ◊ It also permits the effective coordination of activities.

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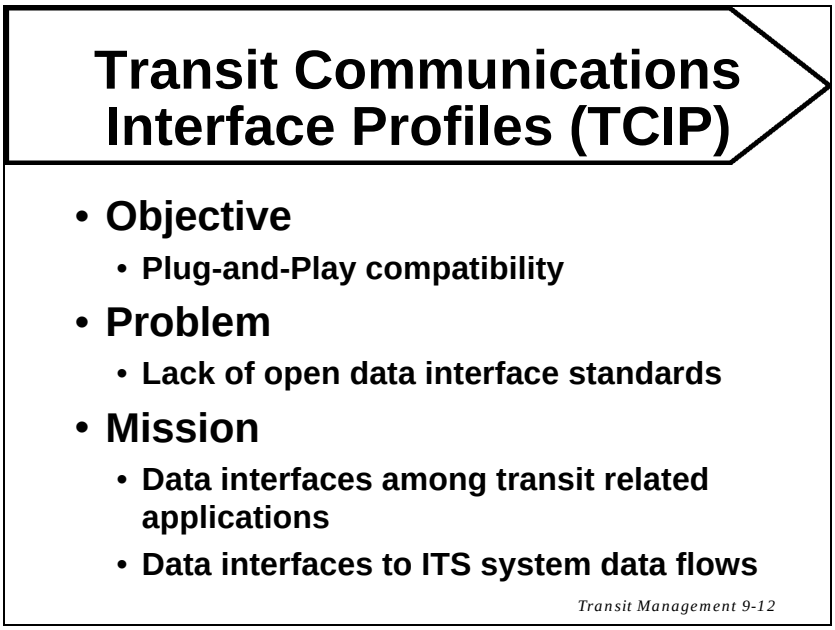
National ITS Architecture and Standards, Continued

Slide: TCIP



TCIP

In transit communications, there are many data interfaces – even more than are outlined by the national architecture.

TCIP is an effort at developing standards that will enable "plug-and-play" compatibility of APTS components.

- TCIP is an integrated component of the National Transportation Communications Interface Protocol (NTCIP).

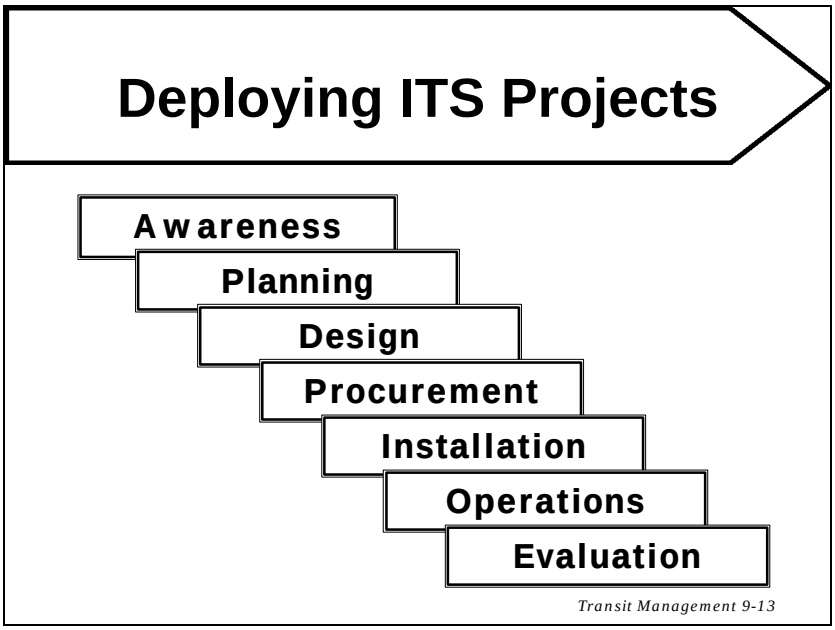
TCIP will define data interfaces to allow data flow among departments, and between and among public transportation vehicles, the Transit Management Center, other transit facilities, and other ITS centers.

- It will also define interfaces between applications and other external entities, such as traffic management centers and emergency management centers.

For more information see *www.tcip.org* and *www.tsconsortium.org*

Deploying ITS Projects

Slide: Deploying ITS Projects



Compare traditional and ITS

A typical project flow chart includes awareness, planning, design, procurement, installation and acceptance, operations and maintenance, and evaluation phases.

- In deployment of any project, close coordination is required among all parties, including the owner(s), the designer, the builder, and the operator of the system.
  - ◊ In traditional projects, these parties are usually separate organizations.
  - ◊ In ITS projects, these four can be a combination of one or more organizations, depending on funding. For example, in transit and highway cooperative procurements, both agencies have ownership of the project.

Note: Some funding sources govern specific legal requirements of the relationship between these parties.

Conformity

USDOT conceptual approach for ensuring conformity to the National ITS Architecture: architecture consistency should be embedded within existing transportation planning & project development processes.

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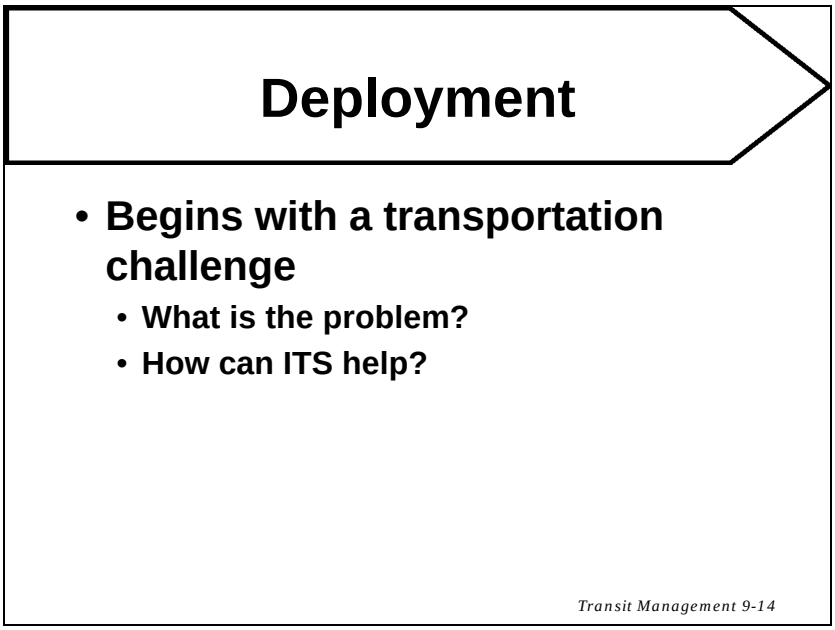
Deploying ITS Projects, Continued

Slide: Deployment



Awareness

What problem are you trying to solve?

Awareness is the stage in which planners and agency personnel, as well as elected officials and the general public, begin to learn about technology that will help them to meet their transit needs.

- This includes special executive awareness scanning reviews for U.S. DOT, state and local executives, transportation specialists, and elected officials, who can learn about and experience deployed ITS systems.
- This also includes the ITS PCB courses.

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Deploying ITS Projects, Continued

Identifying needs

Deployment of a project with ITS begins with a transportation/mobility challenge that needs a solution. A planner:

- perceives a need, identifies a challenge and solution, and refines it with input from:
  - ◊ customer surveys
  - ◊ other jurisdictions/agencies
  - ◊ training courses
  - ◊ media articles and reports
  - ◊ planning meetings
  - ◊ ITS seminars and courses

Staffing

For a project with an ITS component, your existing staff must be evaluated for:

- size
- qualifications
- availability

Additional personnel resources must be defined and requested for:

- training
- implementing
- contracting for specialized services

For additional information, see *An Assessment of ITS Training and Education Needs: The Transit Perspective*, FTA PCB Program.

ITS staffing examples

Different ITS/APTS projects require different staffing and training needs.

- For instance, if you create a transportation control center in a separate building, you may want to shift personnel from one office to fill some of the new positions, and you may need new personnel, such as a telecommunications engineer, for new job functions.
- Similarly, if you install vehicle diagnostics on a fleet of buses, you may need to re-train your mechanics (union).

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Deploying ITS Projects, Continued

Staffing/ training issues

A problem that came up in one agency:

- A non-technical manager was planning for a technical procurement and installation – an interactive kiosk that had a possibility of being used in a welfare-to-work application.
- Federal regulations prevented the manager from seeking technical help from vendors, yet time lines were very tight because the procurement was grant-driven.
- In addition, the grant did not include any money for operations and maintenance.

In this case, FTA staff pointed the manager to the local FHWA ITS specialist, who was able to help out on the technical issues of the procurement.

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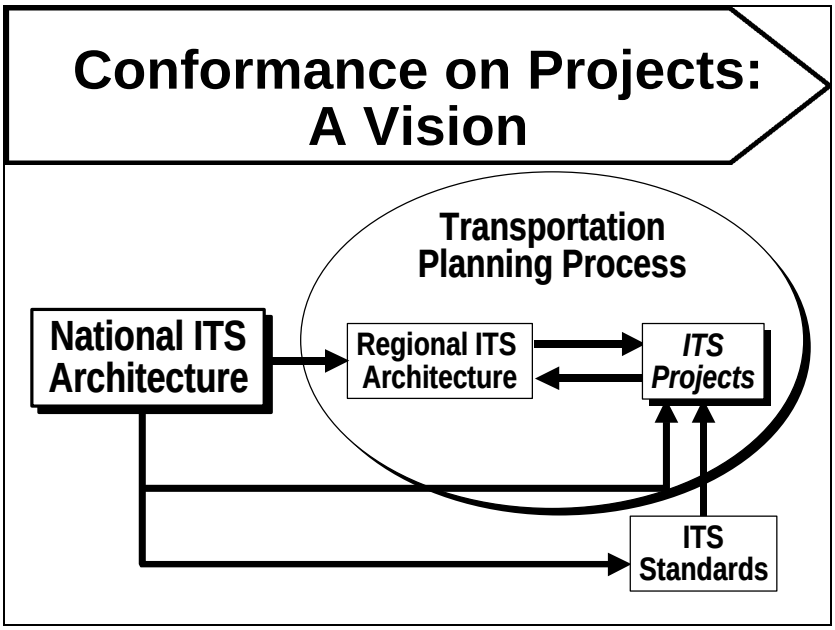
Deploying ITS Projects, Continued

Slide: Conformance on Projects: A Vision



Planning

The conceptual approach to conforming to the National ITS Architecture mainstreams ITS projects into the typical transportation planning process.

Planning covers:
- making decisions
- allocating resources

One of the issues for planning ITS projects is the relative lack of familiarity many transportation planners have with the software development and integration processes.

Classic planning process is:
- defining problems and goals
- identifying possible solutions and alternatives
- evaluating costs
- recommending actions

Source: ITS within the Transportation Process presentation

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Deploying ITS Projects, Continued

Example of mainstreaming: Federal funds - TIP

A project with an ITS component in the regional long-range plan (the 20-year informal plan) must be included in the regional or statewide Transportation Improvement Program (TIP) plan (the formal 3-year plan) if the project needs federal funds in the next three years.

- "Inclusion in the TIP renders projects eligible for federal aid and is a requirement for ITS based on strategies to be eligible for federal aid." —*Source: Goodman, Charles. "ITS and Mainstream Decision-Making Process," ITS Quarterly, Spring 1997, p. 66.*

- Projects should be consistent with the National Architecture and use appropriate ITS standards.

Involvement at the early stages

Getting involvement early of the interested parties is important to the success of an ITS project. Some of the considerations that are unlike traditional projects include:

- Involvement of operations and maintenance people – the end users – early
- Recognizing when changes affect union people – training requirements and union contracts that are involved
- Legal and procurement issues that may come up

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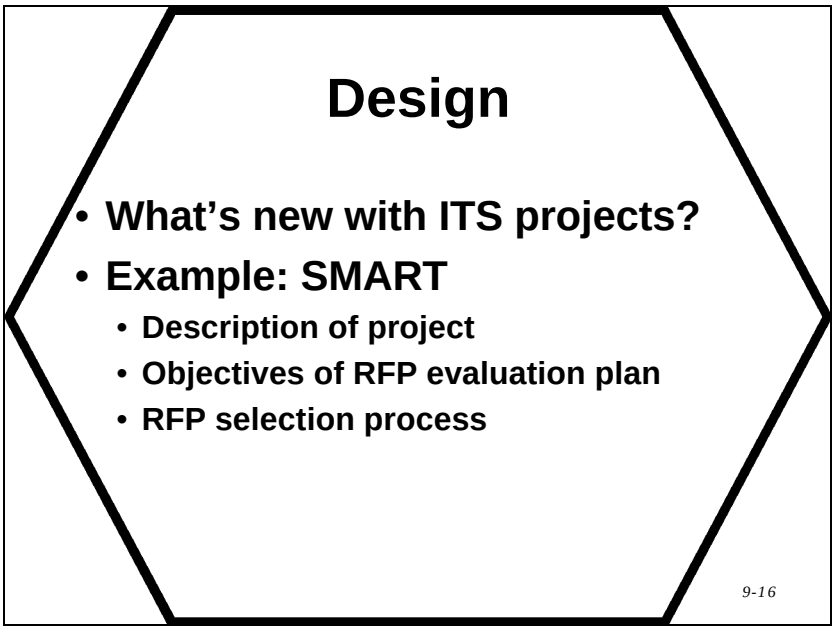
Deploying ITS Projects, Continued

Slide: Design



Design

Design of a project with an ITS component differs with design of traditional projects.

As with any project, the broad requirements of the project must be identified:

- technical
  - ◊ You may need a type of expertise you have never used before (IS/telecommunication/contracts experts/PR).
- financial
  - ◊ public money brings up the issue of intellectual property rights for software development
  - ◊ legal issues of data sharing and liability issues
- labor hours/staffing – union training
- real estate/land acquisition
- time
  - ◊ Time is another key area that you will have to examine. Schedules for ITS projects are often uncertain because the technologies are new.

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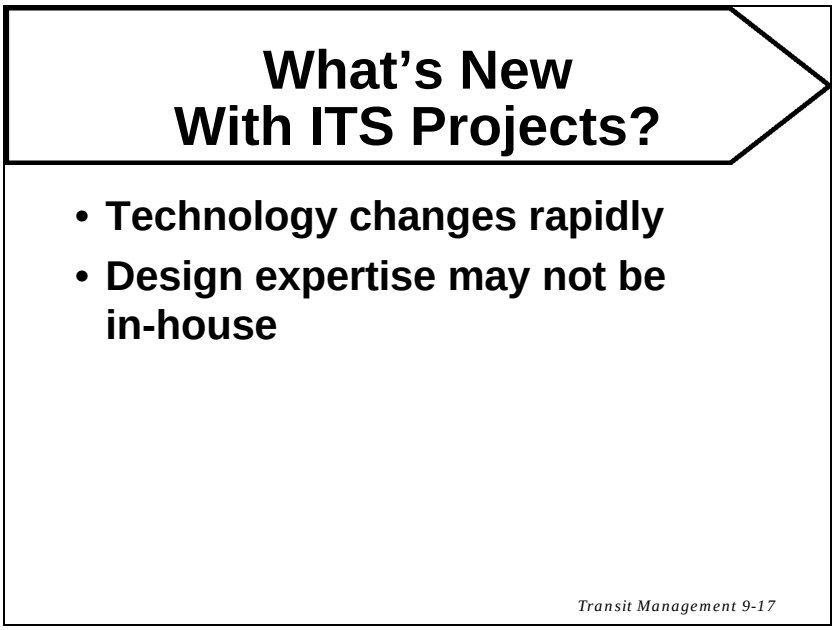
Deploying ITS Projects, Continued

Slide: What's New With ITS Projects?



Build in flexibility

Because technology changes rapidly, traditional design choices may no longer be appropriate.

In particular, exact design specifications are difficult to produce.
- From the time of design to implementation, technological advances may have outdated your design specification.

Many are choosing functional specifications or a combination of functional and traditional design specifications.
- In your project definition, be complete, but build in flexibility, if appropriate:
  - ◊ ITS projects need to have design flexibility built in.
  - ◊ ITS, by its nature, must be designed with links to the ITS infrastructure to allow interconnectivity. The National ITS Architecture helps here.
  - ◊ The rigid nature of traditional projects has presented problems in development of ever-evolving technologies.
  - ◊ ITS projects should have intermodal connections to other parts of the ITS infrastructure.
  - ◊ This is a reason for design-build with general estimate.

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Deploying ITS Projects, Continued

Minimum needs doctrine and ITS

Keep in mind that you might have to go to the next level of technology with ITS projects for future upgrades and compatibility.

- Today, you must make sure you have compatibility for the future in ITS projects. It's like buying a PC – it becomes outdated within a few months.
- This is actually a serious issue facing ITS projects. Technology gets outdated so fast, that the minimum needs doctrine is seemingly in contradiction to the nature of an ITS procurement.
- Flexibility in specifications is the key to success here.

In-house expertise

In general, many differences in this stage involve the decisions about who does the work.

Options include:

- ITS design may be sole sourced
- You may have to hire or contract specific expertise that your agency does not have. For instance:
  - ◊ telecommunications engineer
  - ◊ systems integrator
  - ◊ hardware or software engineer

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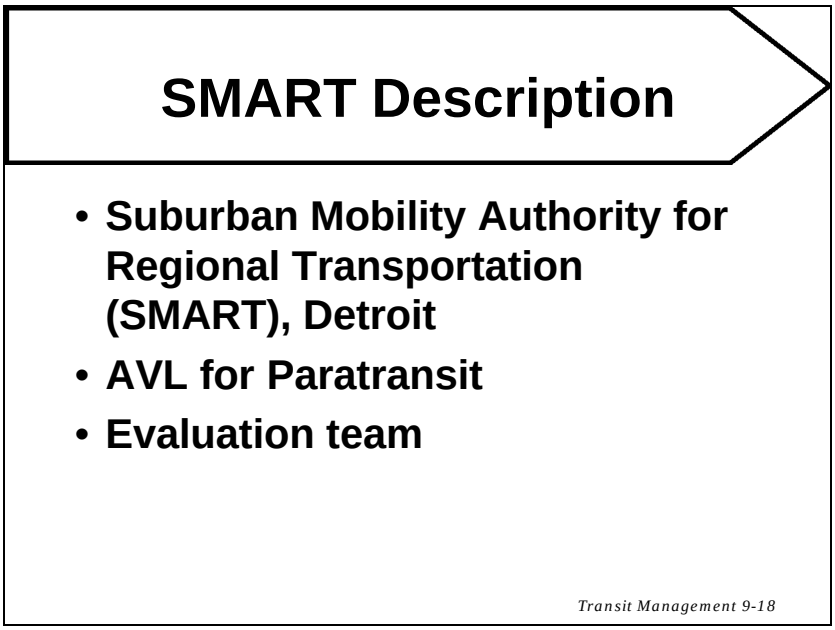
Deploying ITS Projects, Continued

Slide: SMART Description



SMART AVL

The Suburban Mobility Authority for Regional Transportation (SMART) in suburban Detroit put out a Request for Proposals for an automatic vehicle location (AVL) system for paratransit operation in January 1994.

SMART formed an evaluation team to review designs and select vendors' proposals. In order to assist the SMART employees that were responsible for reviewing the resulting proposals, they developed a proposal evaluation plan.

- This plan established the overall administrative procedures and stated the criteria to be used in evaluation of a vendor's proposal to provide the AVL system.

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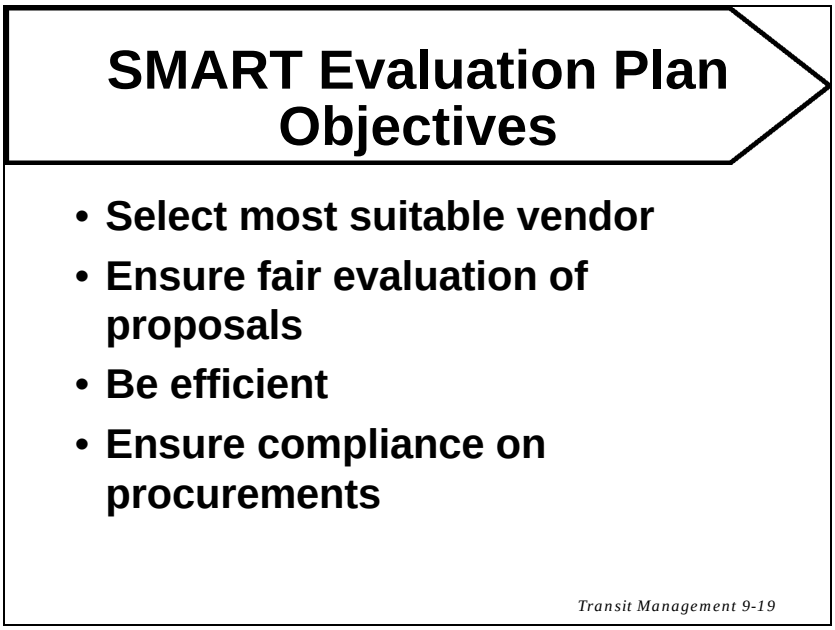
Deploying ITS Projects, Continued

Slide: SMART Evaluation Plan Objectives



Objectives

The primary objectives of the evaluation plan were to:

- select the vendor who would be most suitable to perform the services and provide the equipment in accordance with the specifications and requirements of the RFP;
- ensure objective, equitable and comprehensive evaluation of the proposals;
- make the selection process efficient and coordinated; and
- ensure compliance with FTA guidelines on negotiated procurements as outlined in FTA Circular 4220.1B.

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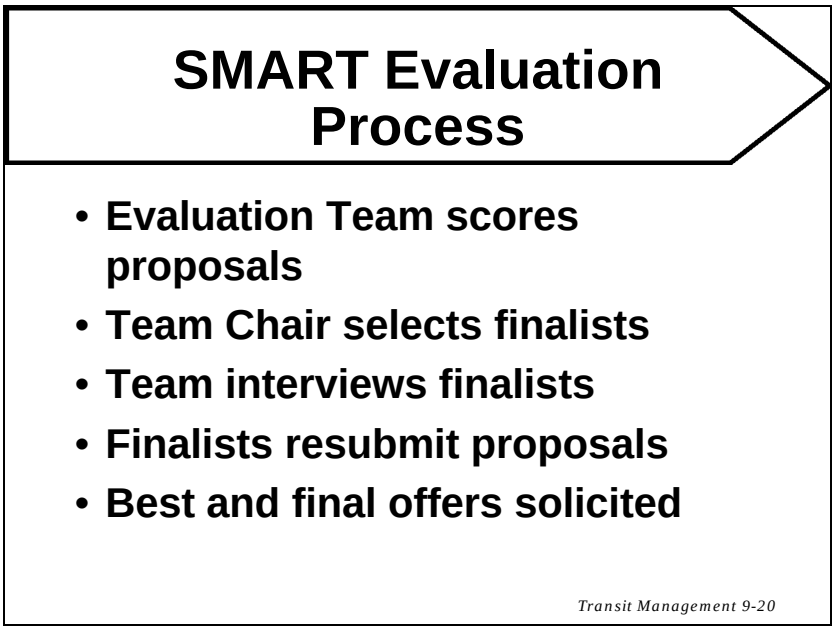
Deploying ITS Projects, Continued

Slide: SMART Evaluation Process



Process for evaluation

The Plan was used by the evaluation team members to evaluate and score the proposals.

After evaluation team recommendations, the evaluation team Chair made the final determination as to which vendors were in the competitive range.
- Discussions were conducted with all vendors in the competitive range.
- Members of the evaluation team were asked to participate in these discussions.

Vendors were then offered a reasonable opportunity to clarify and submit revised proposals.

Best and final offers were solicited after proposals were clarified and re-submitted.

Source for the section on SMART: CT Magazine, September-October 1998. "Taking SMART to the People," author: Scott Bogren, www.ctaa.org/ct/novdec98/smart.shtml

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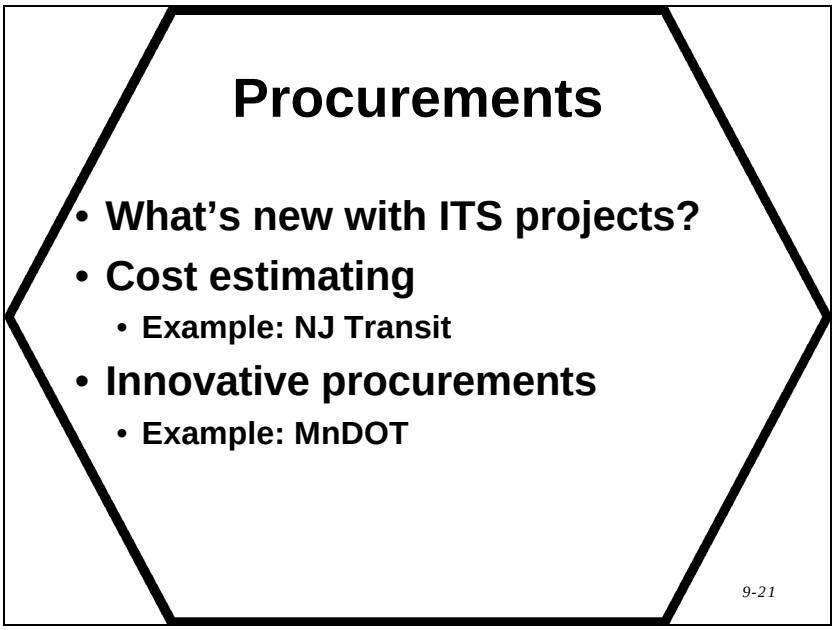
Deploying ITS Projects, Continued

Slide: Procurements



Procurement

Procurement includes steps that you are all familiar with, as they characterize this stage in any project.

However, a project with an ITS component can benefit from innovative funding strategies.

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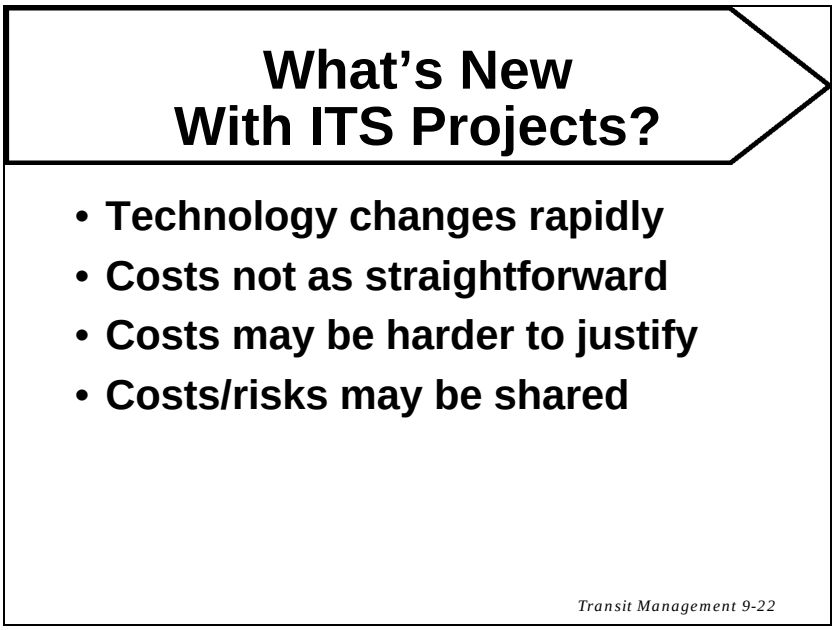
Deploying ITS Projects, Continued

Slide: What's New With ITS Projects?



Technology changes rapidly

The analogy is to buying a PC – by the time you have made the commitment to purchase, you can get twice the power at half the cost.

Open competition and ITS

Costs are not as straightforward in a project with an ITS component.

- Minimum cost alone is dangerous in an ITS project.
- Be sure that you are getting the technology option that you need, both now and for future upgrades and compatibility.

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Deploying ITS Projects, Continued

Benefits analysis

When performing the benefits analysis of the procurement, it may be difficult to project quantifiable benefits in order to justify the procurement.

- The ITS efforts are still young, and results are harder to assess.
- On the other hand, many agencies are beginning to study and report on the benefits that they have experienced so far.

Be sure to include the "soft" benefits in your analysis, as well as quantifiable benefits, e.g.:

- Customer satisfaction that leads to more demand
- Improved safety

For more information, see ITS America www.itsa.org

Compare traditional and ITS

Traditional methods:

- may not be suited to purchase of complex electronic or computer technologies
- usually require full definition of critical systems at the start
- often are provided by a single vendor
- may be cumbersome when applied to ITS projects because:
  - ◊ technology changes too rapidly: an 18 month cycle for equipment, communications, and software requires shorter or more flexible contracting and delivery methods
- Low bid is simpler to establish in traditional methods because there are fewer unknowns.
  - ◊ Low bid is not as useful for a project with an ITS component and is not a factor of success or total system cost because of too many unknowns.
  - ◊ The costs of operations, maintenance, training, equipment upgrade and compatibility, and related life-cycle costs are "nearly always larger than the initial bid" in ITS projects. *Source: p. 25 Innovative Procurement seminar notes.*
- The contractors you are used to from traditional projects often do not have the expertise and experience to deliver a project with an ITS component.
- ITS projects usually require an iterative process to deploy.

All of these reasons may encourage you to start small and specific with your ITS projects, and plan for integration as you progress with all your projects.

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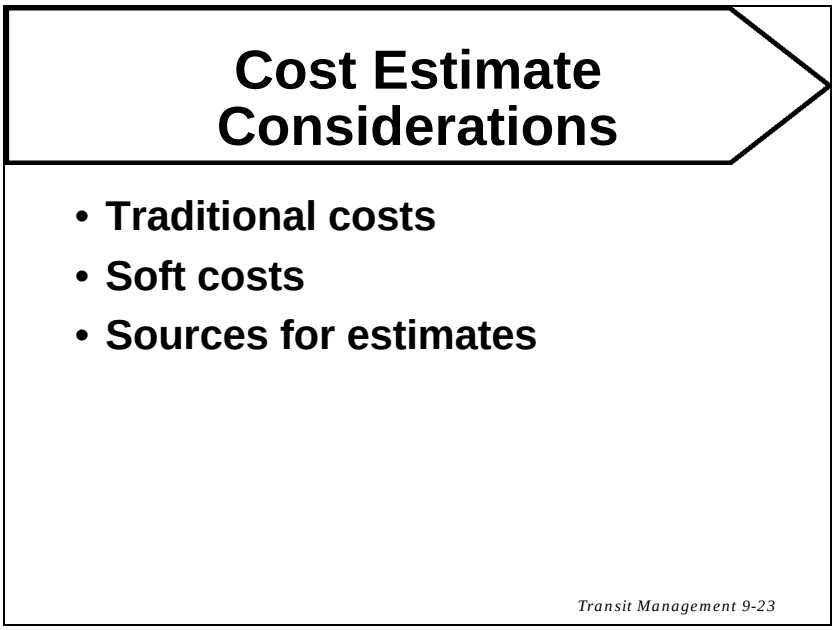
Deploying ITS Projects, Continued

Slide: Cost Estimate Considerations



Funding: Cost estimates

ITS project costs are more difficult to estimate than traditional projects because of longer, more intensive operations and maintenance requirements.

- Software development is expensive and open-ended.

In addition to cost estimates for items in a traditional project, such as capital costs and operations and maintenance costs, you will also need to consider soft costs that are specific to a project with an ITS component.

- Cost estimates should also include upgrade costs for software and hardware maintenance.

Continued on next page

Deploying ITS Projects, Continued

Soft costs

Cost estimation should include soft costs, which include:
- planning
- engineering and design
- project and construction management
  - ◊ equipment and other software startup costs
- training costs
  - ◊ start-up
  - ◊ maintenance training
  - ◊ operations training

One important soft cost that invariably arises in ITS projects is the cost of implementing new systems and conversion costs of old systems, including:
- data development and conversion
- software needs
- transition period

Sources for estimates

Some sources for finding comparable cost estimates for ITS projects include:
- FTA and FTA studies
  - ◊ Light Rail Transit Capital Cost Study
  - ◊ Fixed Guideway Capital Costs, Heavy Rail and Busway/HOV Lane
  - ◊ The Transit Capital Cost Index Study
- other agencies (e.g., state or local DOT)
- vendors
  - ◊ first get verification of vendors expertise
- ITS National Architecture CD
- Local construction records and service history
- Engineering documents
  - ◊ Engineering News Record
  - ◊ F.W. Dodge Reports

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Deploying ITS Projects, Continued

Managing the procurement

In ITS projects, technology and software issues may impact scheduling and delivery. You want to be sure to plan financially and contractually for any issues that come up.

- Establish a system of internal control which ensures that:
  - ◊ all cost approvals are obtained and payment is within the amounts of the contract
  - ◊ time schedules are adhered to
  - ◊ the quality of work, construction, or service is within the terms of the contract
- Establish procedures for the monitoring of procurement activities and for ensuring that contract requirements are met.
- Resolve disputes and claims among separate contractors or between contracting personnel and the contractor.

Build in flexibility

In general, for any ITS project, you will want to build flexibility into the contract.

- Procurements take time.
- In the contract, you can revise the technical specifications just before the actual purchase.
  - ◊ e.g., if you have a six-month procurement approval process for a project with an ITS component involving computer-aided dispatch, computer hardware may have changed or decreased in price. By including some flexibility in the contract, you can upgrade to a better machine with the same funds specified in your proposal.

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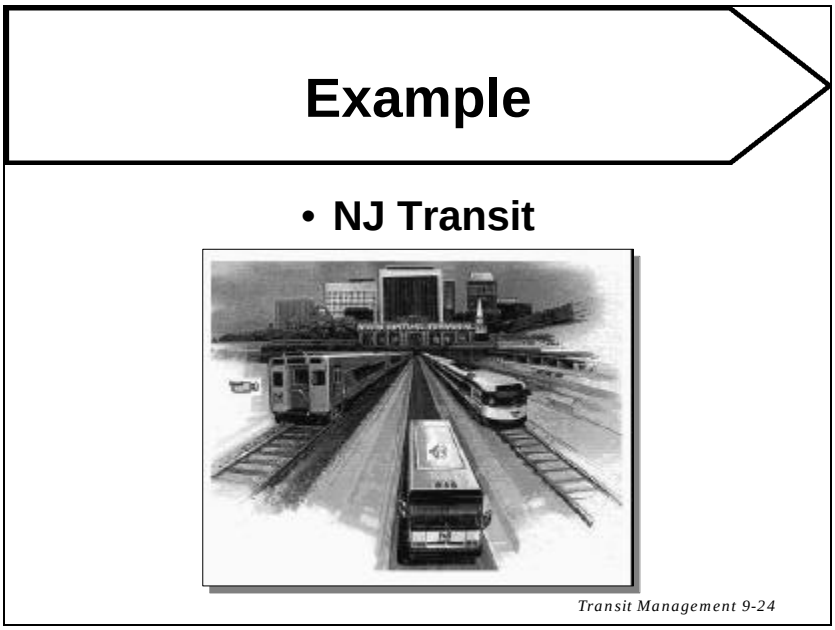
Deploying ITS Projects, Continued

Slide: Example



NJ Transit APCs

NJ Transit demonstrated an APC system from November 1993 through April 1994. Six NJ Transit buses (4 - 40" Flexibles and 2 - Volvo Articulated) were instrumented with APC sensors (infrared beam-based technology), cables and on-board processing units. The APC equipment was assigned to the Big Tree garage and deployed on a daily basis to runs on four urban transit routes. For the five-month demonstration period, the APC system was operated in much the same manner as if it were permanently deployed.

Cost of producing data

The APC system demonstrated its ability to produce detailed data at a fully allocated cost of less than $4.00 per hour of usable data, including system maintenance. Manual data collection costs $45 per hour.

Source: New Jersey Transit, www.njtransit.state.nj.us

Continued on next page

Deploying ITS Projects, Continued

Funding plans

Two deployment plans were developed in July 1996:

- One assumed full funding for procurement and maintenance of all 158 APCs desired by service planning.
- One assumed funding constraints that require cutting back APC quantities in less critical areas – most notably on cruiser routes where fare register data may tell much of the story much of the time.

RFP

In September 1997, NJ Transit issued a request for proposals (RFP) for an APC and Data Management System.

- The project scope included field data collection accomplished through statistical sampling, by deploying APC equipment on defined subsets of the bus fleet, together with automated data transfer equipment at respective bus garages, and hand-held data loggers for manual collection of passenger count information.
- Associated data management capabilities were defined to be provided by appropriate APC data processing, data extraction, transformation, storage, query, analysis, report generation and information support technologies installed at NJ Transit corporate headquarters.
- Proposals on this project were due in December 1997.
- NJ Transit has had a vendor under contract since March 1998.

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Deploying ITS Projects, Continued

Appropriate traditional methods

Many traditional methods of procurement, such as sealed bids, or non-competitive proposals, may not be appropriate for ITS procurements because of their inflexible nature.

The following traditional procurement methods can be appropriate for ITS procurements with some modifications.

Method	Description
Request for Proposal	• Used when sealed bids are not appropriate, such as when the price of a service is not the major consideration of the project. (For example, a project might cost more, but be completed earlier.) • Require that: ◊ the RFP (request for proposal) be publicized and contain all evaluation factors along with their relative importance ◊ proposals be solicited from an adequate number of qualified sources ◊ a procedure be in place to conduct technical evaluations of the proposals and for selecting awardees ◊ awards be made to the responsible firm whose proposal is most advantageous to the grantee's program with price and other factors considered
Architectural & Engineering	• Applicable for architectural and engineering services and also: ◊ program management ◊ construction management ◊ feasibility studies ◊ preliminary engineering, design, surveying, mapping, and services which require performance by a registered or licensed architect or engineer • Uses procedures based on the Brooks Act, which requires: ◊ a bidder's qualifications be evaluated ◊ price be excluded as an evaluation factor ◊ negotiations be conducted with only the most qualified bidder ◊ failing agreement on price, negotiations with next most qualified bidder be initiated until a fair and reasonable contract is made

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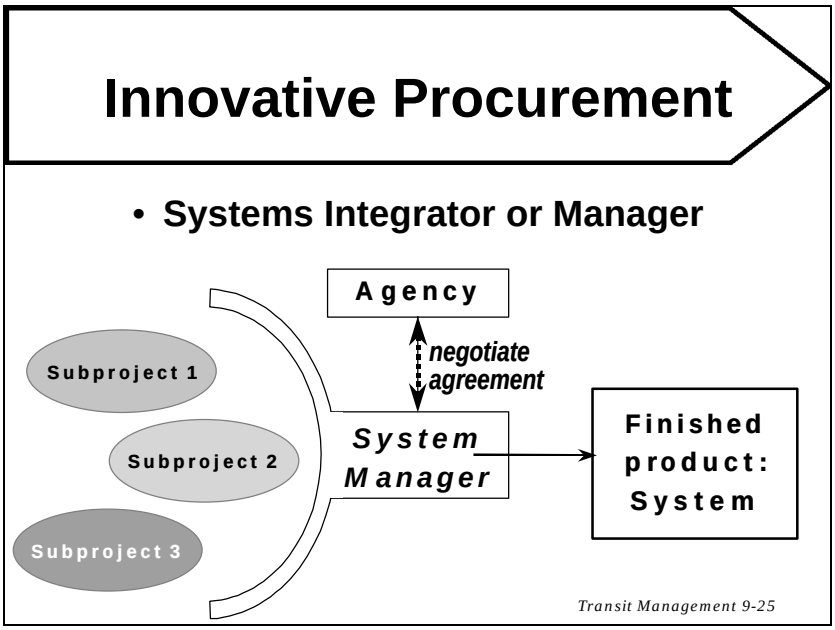
Deploying ITS Projects, Continued

Slide: Innovative Procurement



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Deploying ITS Projects, Continued

Systems integrator/ manager

This procurement method divides the project into several sub-projects for each of the various subsystems, with the work overseen by a systems manager who administers each contract and is responsible for integrating the subsystems into an overall operating system.

The agreement between the agency and the system manager is negotiated to provide flexibility when compared with a typical fixed price design-build contract.

Risks of this method include:
- management difficulties and payment issues
- it tends to encourage a big, loosely defined contract with little or no built-in success measures
- changing a system manager requires a large learning curve

Benefits include:
- Integration and compatibility are more likely to occur with a single manager looking out for the whole program.

Systems integrators usually stay with the project through the operations phase.

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Deploying ITS Projects, Continued

Innovative financing - FHWA

Innovative financing techniques for ITS FHWA projects are now available to all states as part of the NHS Act and administrative change to be used for highway projects.

FHWA and states are using:
- leveraging tools
  - ◊ flexible match
  - ◊ federal share on toll projects
  - ◊ bond and debt instruments
  - ◊ ISTEA 1012 loans
  - ◊ ISTEA section 1044 Toll Investment Credits
- cash flow tools
  - ◊ advance construction
  - ◊ partial conversion of advance construction

Transit is beginning to explore similar innovative financing methods.

Innovative financing - transit

Among techniques which may reduce costs for transit agencies are the following:
- leasing transit vehicles instead of purchasing, thereby requiring less in start-up costs and allowing the owning agency to gain tax advantage through depreciation
- leveraging funds through investment
- entering into public-private partnerships with businesses located in the vicinity of transit stops, which will benefit from upgrading the facilities
- pooled purchases by several transit agencies simultaneously in order to drive down cost per item
- various other techniques as described in the "Best Practices Procurement Manual"

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Deploying ITS Projects, Continued

Leveraging

In ventures involving funds from more than one source, a manager can make decisions that affect how much use is made of available funds.

- Funds from a federal grant must be expended to pay bills on hand.
- State and local funds are governed by their own rules, and possibly may not have to be committed at once.
- Private loans and investments can often be banked and allowed to draw interest until federal funds (and possibly state and local funds) are exhausted.
- Income from a project, such as stored value cards, can be invested and allowed to draw interest.

Example of funds management: Splitting the invoice

An example of innovative funds management:

- Southeastern Pennsylvania Transportation Authority (SEPTA) has a local share for capital projects that are funded by the State of Pennsylvania and the five counties that make up its service district.
- Formerly, when SEPTA received an invoice from a contractor, the Authority would:
  - ◊ bill the FTA and local agencies (to include the State) for their shares of the invoice
  - ◊ receive payment from the FTA within three days
  - ◊ wait 30 to 60 days for the rest of the payment from local agencies and reimburse itself when the local funds arrived
  - ◊ use the FTA payment and its own funds to pay the invoice
- In May 1992, SEPTA decided to let the contractors bear the burden of underwriting the local share cost by:
  - ◊ splitting each invoice into a federal share and a local share
  - ◊ paying each share with funds after they were received from the federal or local source
  - ◊ paying the FTA portion within 10 days and the local portion within 30 to 60 days
- The revised payment system shifts the burden of the delay to the contractor.
- SEPTA now uses its money immediately to meet transit needs, rather than covering the local share of the invoice.

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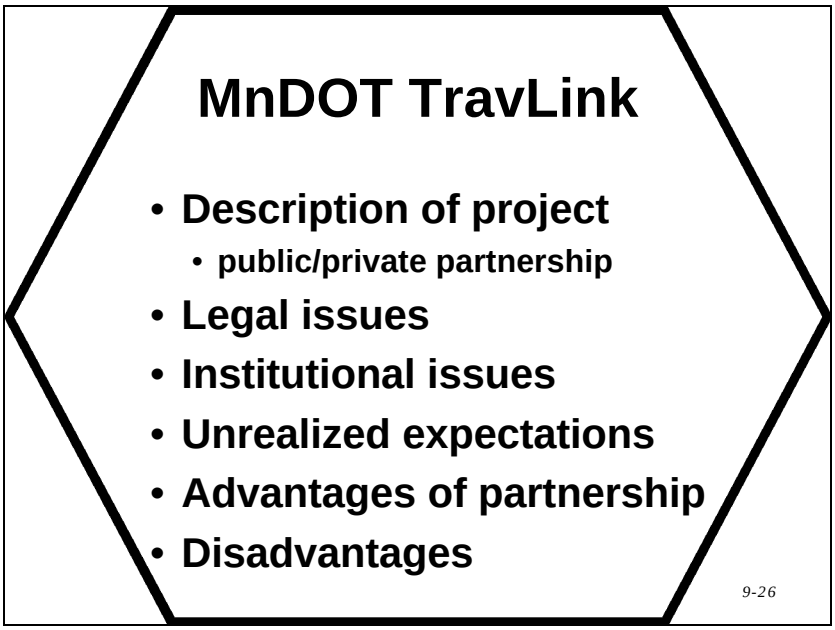
Deploying ITS Projects, Continued

Slide: MnDOT TravLink



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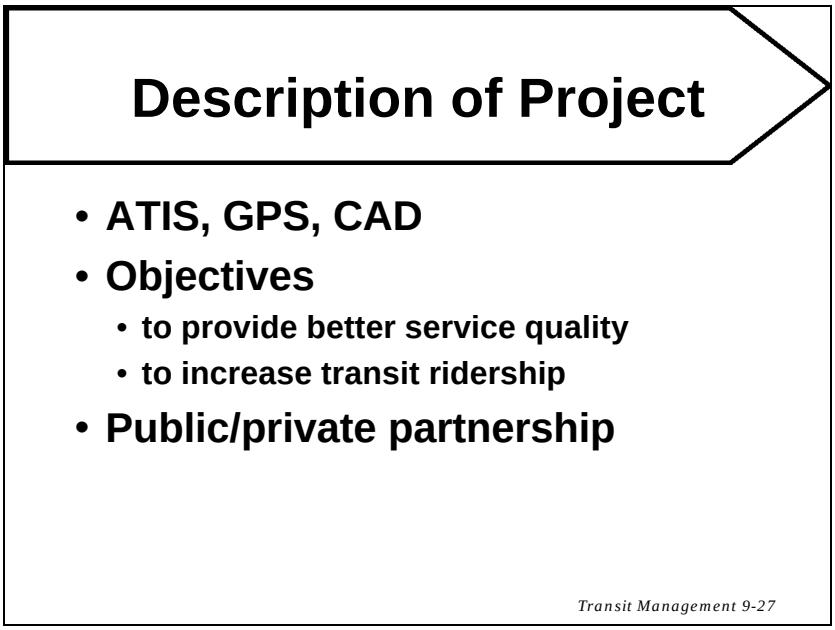
Deploying ITS Projects, Continued

Slide: Description of Project



MnDOT TravLink

In the TravLink project in Minneapolis/St. Paul, the state DOT was interested in developing a public/private partnership for the project. This partnership would include private partners who would contribute in-kind services as part of their partnership agreement.

Because of some limitations in Minnesota's state laws regarding partnerships, the partnership arrangements envisioned for the TravLink project could not be developed without a change to the state laws.

While changing legislation would seem to be a daunting and very time-consuming task, Minnesota DOT felt that it was important enough to pursue.

- In less than one year, DOT was able to get the appropriate laws changed to allow the kind of partnerships they desired for the TravLink project.

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Deploying ITS Projects, Continued

System description

TravLink operational test involved a GPS/AVL/ATIS system for eighty buses that operate in the I394 corridor. TravLink uses several devices and media to distribute real time and static information, including:
- Smart kiosks
- Display monitors
- Electronic signs

The test evaluated the customer's preferences for content of messages and immediacy, as well as location of information availability.

CAD/AVL integrated:
- Dispatch functions
- Communications
- Incident management
- Fleet control
- Tracking schedule and route deviations

MDTs were used on-board the buses.

In addition to GPS, signposts were used in the high occupancy vehicle (HOV) lane. This will aid the buses in acting as traffic "probes."

Key to partners and stakeholder selection: Identify personnel

Personnel and agencies whose roles influence the implementation of the project must be identified:
- regional jurisdictions
- local government agencies (police, fire, medical, social services)

Keep in mind that one of the key differences with respect to a project with ITS is the amount of convincing you may have to do. Buy-in at the decision-maker level often depends upon convincing analyses and cost benefits unlike what you may be used to in traditional projects.

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Deploying ITS Projects, Continued

Slide: Legal Issues

Legal issues of TravLink

"The major stumbling blocks to carrying out the agreements were legal issues. The key issues of concern included proprietary issues and property rights; copyright and ownership; license agreements; confidentiality; and ability to carry out partnership agreements under Minnesota enabling legislation."

Source: 6th Annual Meeting Abstract, author: Tom Buffkin, www.itsa.org

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Deploying ITS Projects, Continued

Ownership

Technology promotes intermodal integration. In the future, you will likely be involved in a project that is shared with another agency.

If a joint agency project is attempted, you must determine which agency is best suited to carry out requirements for:

- planning, design, construction, installation, and operations
- initiating and maintaining financing from:
  - ◊ public funds
  - ◊ taxation
  - ◊ bonds
  - ◊ receipt of federal and state grants
  - ◊ partnerships
- procurement and awarding of contracts
- real estate acquisition and condemnation
- determining legal authority and constraints of agencies involved

Continued on next page

Deploying ITS Projects, Continued

Slide: Institutional Issues

TravLink issues

"The key non-legal stumbling blocks identified included the turnover of key staff mid-way through the project; internal staff resources and competition; obtaining senior level buy-in; and lack of a single project manager."

Source: 6th Annual Meeting Abstract, author: Tom Buffkin, www.itsa.org

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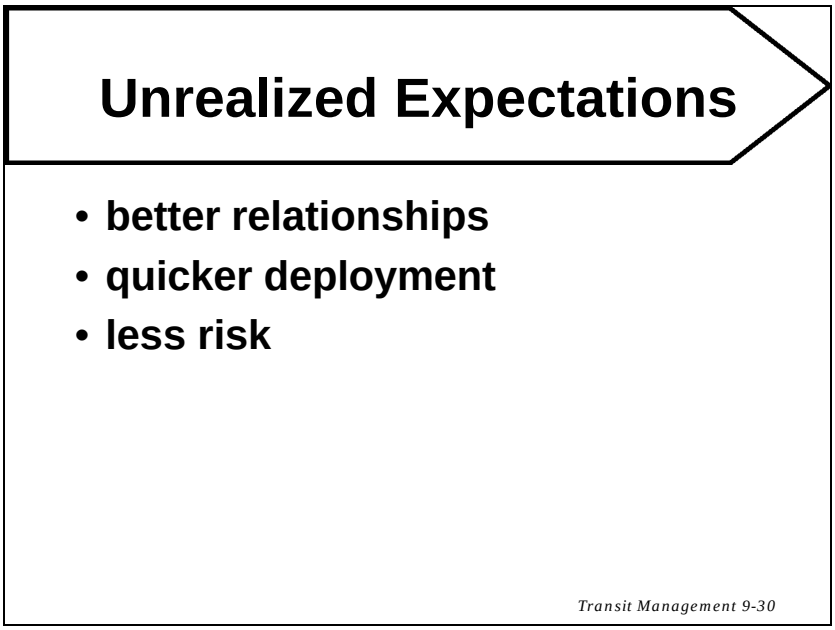
Deploying ITS Projects, Continued

Slide: Unrealized Expectations



Unrealized expectations

"Many of the participants, both public and private, expected different (and better) working relationships to develop from the public/private partnership process. Several of the participants expected that the partnership process would allow them to explore new technologies and bring them to a test market more quickly, and with less risk than a traditional approach. The partnership would also allow the public sector to explore these technologies while leveraging public funds."

Source: 6th Annual Meeting Abstract, author: Tom Buffkin, www.itsa.org

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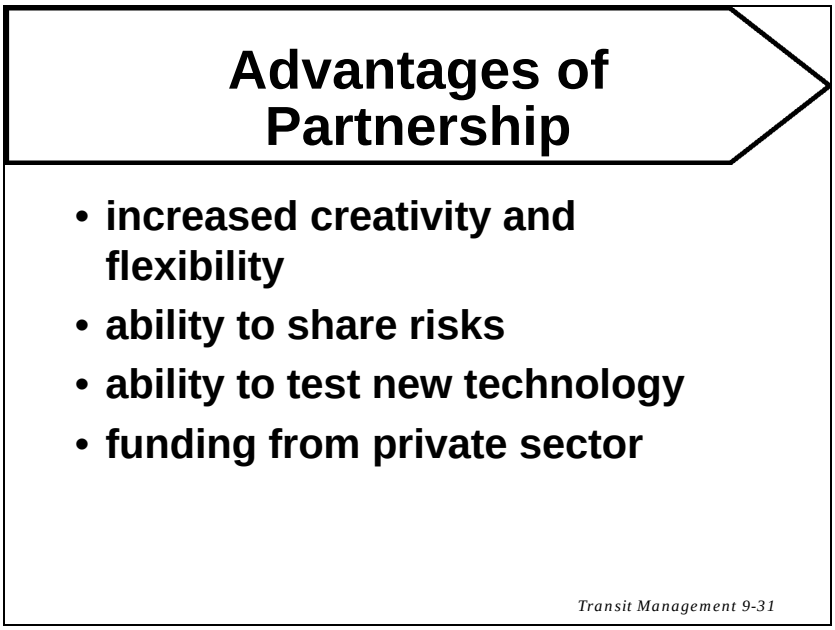
Deploying ITS Projects, Continued

Slide: Advantages of Partnership



Advantages

"Among the positive benefits of the partnership approach were: creativity and flexibility; the ability to share information and resources; the ability to share risks; the ability to test leading-edge technology; and the funding potential associated with private sector contributions."

Source: 6th Annual Meeting Abstract, author: Tom Buffkin, www.itsa.org

Transit partnerships

In Minnesota and California, experienced ITS project managers recommend setting up a consortium of transit properties and vendors for the purchase of standardized, off-the-shelf products by creating a large enough pool for sales to keep the vendors in business.

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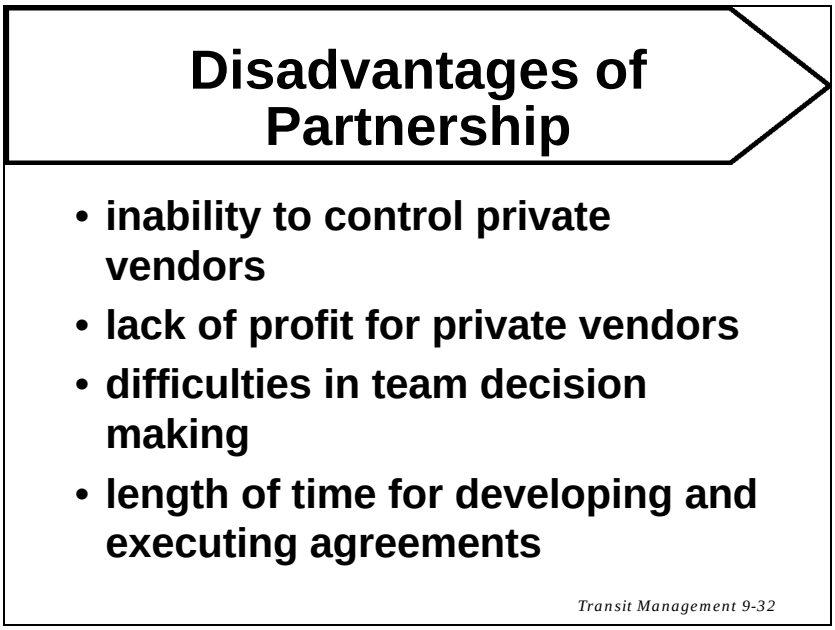
Deploying ITS Projects, Continued

Slide: Disadvantages of Partnership



Disadvantages

"Among the negative impacts were: the inability to control private vendors and enforce the agreement; the lack of profit for private vendors; the difficulties associated with team decision making; and the length of time involved in developing and executing the agreements

In summary, the most interesting finding overall was that although all of the participants noted problems associated with public/private partnership agreements, all of the private partners, and several of the public participants, have been involved in at least one, if not several, partnership agreements since Travlink."

Source: 6th Annual Meeting Abstract, author: Tom Buffkin, www.itsa.org

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Deploying ITS Projects, Continued

Slide: Final Stages

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Installation and acceptance

For installation and acceptance testing, the following differences apply:

- costs need to be watched closely, especially if you're dealing with new technology
- new staff will include technology specialists
- if the installation includes software, you should be prepared for delays

Operations and maintenance

The operations stage of a project with ITS:

- The differences in this stage have to do with the staffing needs, training needs, and technological maintenance needs.

If the ultimate operator or maintainer is unionized, make sure that the needed training is both allowable by union contract and specifically identified in the procurement contract. Vendors often provide the training for ITS to O&M staff, but it helps to specify it as part of the agreement.

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Deploying ITS Projects, Continued

Keys to long-term success

Think long-term when making the agreement.
- Include warranty information
- Include conditions that guarantee that equipment and parts will be available for a certain number of years
- Low bid process can cause serious problems in these areas.

Evaluation

In some areas, the project is evaluated to quantify benefits and operational success.

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Deploying ITS Projects, Continued

Slide: Keys to Success

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Keys to success

A project with an ITS component differs from traditional projects because of the technology, the method of procurement, legal issues, staffing, etc.

- Be sure to include methods for systematic review of the project including system software development.
  - ◊ Software reviews must identify ways to measure progress and completion.
  - ◊ Many interim design reviews are necessary, even if it means paper reviews of screens.
  - ◊ The staff who will use the system must be involved in these reviews from the start.
- Warranty:
  - ◊ In many design-build procurements, greater responsibility and risk is placed on the contractor.
  - ◊ Make sure your contract includes extended liability insurance or warranty clauses so that the finished project will perform as required and is on time.

Keys to success table

Nearly all successful projects have features that provide opportunities for success. While not required, these features make a difference in how the project develops and is carried through to completion.

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Deploying ITS Projects, Continued

Key to Success	
What	
Start Small	• Break projects up into components and start small as resources allow. • Keep in mind integration with other modes, with other projects, and with the future.
Define the project precisely	• Define the project early, in the planning and design stages, with precise limits on what is to be developed and constructed. ◊ Any subsequent change nearly always promotes disorder, confusion, and increased costs. • Ask yourself if you are trying to get a service or a product. ◊ this distinction can help to minimize risk • Understand the existing planning process. • Prove that ITS addresses your transportation needs. • Focus on customer service. • Recognize and plan for ITS operational requirements. • Understand the functions and activities discussed in this lesson.
Who	
Identify champions	• Every project needs an identified, primary champion. ◊ for clarification of leadership ◊ for resolution of internal conflicts ◊ as a spokesperson ◊ According to feedback from agencies with successful ITS projects, a champion is essential.
Get local support	• Local support from residents, public interest groups, and business interests is essential for the flow of the project. • Be sure to share information with critical others inside and outside of your organization.
Assemble a management team	• Include interested parties and the experts you need: e.g., ops, legal, end users, etc.

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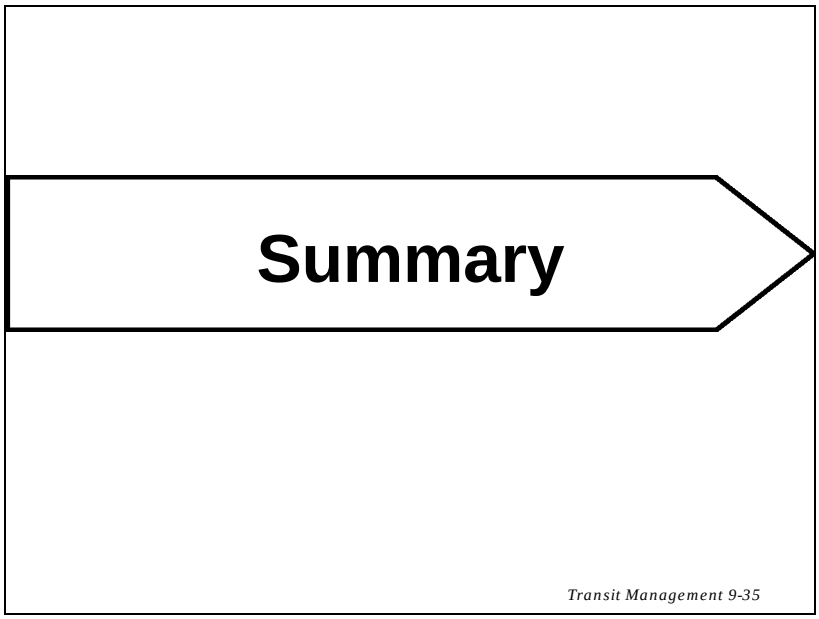
Deploying ITS Projects, Continued

Key to Success, *cont.*	
How	
Share risks	Use flexibility in how you approach risks: • Accept an appropriate share of the risks incurred: ◊ financial ◊ resources ◊ manpower ◊ time • Clearly identify and separate: ◊ financial risks ◊ design risks ◊ software development and integration risks ◊ implementation risks • Assign more risk to the party with the most opportunity for financial gain • Assign each risk to the party who can best control it, and still survive should the risk become reality ◊ e.g., tie software deadlines to paying the contractor • Use the National Architecture and standard interfaces to help minimize risks
Identify obstacles	• The key people you need to convince, such as elected officials and staff may be unfamiliar with ITS. • Use marketing techniques to help sell the project, e.g. a 5-7 minute video, brochures, etc. • Successful integration requires coordination inside and between modes. • Your own staff may have limited resources and experience. • You may be hindered by the lack of data on ITS benefits and costs. • You may have commitments to other projects.
Analyze benefits for the stakeholders	• Identify non-traditional transit problems in your area, e.g. : ◊ passenger mobility rather than facility congestion ◊ passenger travel time reduction on public transit ◊ reduction in accidents • Identify the cause of the problems: ◊ Is it caused by lack of information? ◊ Is it caused by demand peaks? • Consider ITS as an independent solution, and as a part of a traditional solution. • Make sure evaluation methods of traditional and ITS projects are equivalent. ◊ Know the limitations of traditional analysis tools, e.g., do they address mobility needs? • Do not oversell the project to management: ◊ Be realistic and specific - avoid benefits claims that you cannot quantify. • Do not undersell the project to management: ◊ Your benefits analysis will make the project gain approval. • Non-traditional benefits analysis: ◊ Provide a simulation to help quantify benefits. ◊ Address various market segments to clarify benefits, e.g., the five rural market segments identified by Advanced Rural Transportation Systems.

Deploying ITS Projects, Continued

Slide: Summary



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Deploying ITS Projects, Continued

Transit Management Training Course	Title	ITS Professional Capacity Building: Technical Seminars	ITS Professional Capacity Building: Short Courses	NTI course
Module 9: ITS Project Deployment	ITS and the Transportation Planning Process	x		
	ITS Public/Private Partnerships	x		
	Innovative Finance Strategies for Deploying ITS	x		
	ITS Systems Engineering/Architecture	x		
	The National ITS Architecture: An Introduction for FTA Senior Staff	x		
	Using the National ITS Architecture for Deployment		x	
	Procuring New Technologies for Transit			x
	Market Segmentation for Transit			x
	An Effective Change Order Process			x
	Contract Administration			x
	Cost and Price Analysis & Contract Negotiations			x
	Financial Programming for Metropolitan Planning Organizations (MPOs)			x
	Forecasting Travel Demand for Transit and HOV			x
	Introduction to Metropolitan Transportation Planning			x
	Management of Transit Construction Projects			x
	Noise and Vibration Impact Assessment			x
	Orientation to Third-Party Contracting			x
	Orientation to Transit Procurement			x
	Planning the Integration of Transit and Traffic ITS Applications			x
	Public Involvement in Transportation Decision-making			x
	Statewide and Metropolitan Transportation Programming			x
	Third-Party Contracting: An Executive Overview			x
	Training Program for Major Investment Studies (MIS)			x

Exercise 9-1: ITS Deployment

In this exercise

You will:
- list procurement strategies which you will consider for your agency

Directions

Read the success story provided below and answer the questions that follow.

UDOT

Salt Lake City, the site of the 2002 Olympics, is deploying a number of ITS projects. Utah DOT has been working cooperatively with Georgia DOT, home to the 1996 Atlanta Olympics.

Salt Lake City is relatively new to ITS technologies, which in some ways is an advantage. Atlanta did not have the benefit of the National ITS Architecture being in place, nor did it have the benefit of all of the deployments ("lessons learned") by transit agencies around the country.

Two interesting developments have occurred: an innovative partnership and an innovative RFP.

Source: News – ITS America web page

Innovative partnership

Innovative partnership:
- GDOT is sharing its ATMS software with UDOT for free after spending $7 million in development costs.
- UDOT will give GDOT any enhancements that will be done, free of charge.
- Enhancements planned include:
  - ◊ using different manufacturer's workstations
  - ◊ site-specific maps
  - ◊ new GIS requirements
  - ◊ signal control software
  - ◊ centralized ramp metering

Source: News – ITS America web page

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Exercise 9-1: ITS Deployment, Continued

Innovative RFP

For one of their RFPs, UDOT initiated a vendor fair.

- All noted ITS vendors were invited to a 4-day conference.
  - ◊ UDOT made it clear up front that no commitments were implied.
  - ◊ Each vendor presented for 2 hours
- All transit, FOT, city engineers, county engineers, etc. attended.
  - ◊ Questions were asked during the presentations.
- After the fair, the group got together and drafted their RFPs with a much better understanding of what they might want/need/use.
- Several participants commented that this was the only way they were able to "spec" out their requirements for the RFP.

Question 1

What is most interesting to you and your transit agency about the approaches UDOT has taken?

Question 2

List the major stakeholders who have an interest in the outcome/development of your ITS projects. Include players from other agencies and from regional offices who may have an interest.

Continued on next page

Exercise 9-1: ITS Deployment, Continued

Question 3 How is the private sector involved locally in your area in ITS? How familiar are local resources with ITS? Are there any promising opportunities for partnering with the private sector in your area?

Question 4 Describe any local ITS initiative in your area. Who is sponsoring it? Who is funding it? Has it been well received by the public?

Question 5 Does your area or agency have any policies in place that will affect deployment of a project with an ITS component? How?

Background: The National ITS Architecture

Source

The following material is from:

U.S. Department of Transportation
ITS Joint Program Office
Room 3422, HVH-1
400 7th Street, SW
Washington, DC 20590
(202) 366-9536

Web site: *www.its.dot.gov*

Why is it important?

Just like in building a house, the National ITS Architecture is a master blueprint for building an integrated, multimodal, intelligent transportation system. It defines the framework around which a generally common ITS infrastructure can be developed, while ensuring that local needs are met. This will help state and local decision-makers plan smarter and buy smarter, ultimately saving time and money in the future.

The National ITS Architecture provides insight into the broad range of transportation functions and technical data flows that an ITS implementer should consider when planning or implementing systems. Without it, in the narrow scope of a single project, designers may overlook the numbers of information exchanges that should be considered in the larger context.

By framing these information flows, the National ITS Architecture also serves as a tool that provides stakeholders with an understanding of the entire transportation network and how various service providers can work together. It serves as a focal point for agency leaders to consider new ways of enhancing the existing physical infrastructure to provide the most efficient transportation system possible. Leaders concerned with metropolitan, rural and commercial vehicle intelligent transportation systems will all benefit from using the National ITS Architecture.

Continued on next page

Background: The National ITS Architecture, Continued

What will it help me do?

Using the National ITS Architecture saves significant time and effort for local project planners and implementers. It also helps minimize many of the risks associated with deploying any major transportation system.

National Architecture

- Save time and money
  - ◊ The National ITS Architecture has already done most of the high-level ITS planning and system interface design for you. It provides the basis for state and local ITS decision-makers to understand the potential ITS has for regional and statewide applications.

- Ensure compatibility
  - ◊ For state and local decision-makers, the National ITS Architecture minimizes the risks associated with buying individual components of an expensive transportation system. It provides a high level of confidence that future components will be technically compatible.

- Enable future expansion
  - ◊ Using the National ITS Architecture will allow designers to consider the technical requirements for future system expansion. In applying the National ITS Architecture at the regional and state levels, future transportation needs can be anticipated and planned. Even people who are only in the first stages of implementing ITS can consider future enhancements and know that system expansions will be easier and cost-effective.

- Bring stakeholders together
  - ◊ ITS will only be successful if all of the transportation stakeholders are involved in its planning and have bought into a long-range ITS vision. Applying the National ITS Architecture at the regional levels helps facilitate the inclusion of a broad range of stakeholders in the planning and implementation stages.

Continued on next page

Background: The National ITS Architecture, Continued

Flexibility

Importantly, using the National ITS Architecture does not imply a "one size fits all" approach to designing intelligent systems at a statewide, regional or project level. In fact, it is extremely flexible and will accommodate and tailor to local needs while still maintaining an overall framework for compatibility.

What is the end result?

The vision of the future is to have a nationwide system where individual travelers, businesses, traffic and transit managers, emergency service providers and motor carriers will benefit from integrated transportation systems linked together across the country. The National ITS Architecture provides the framework for compatibility necessary to achieve this vision.

What do I do next?

Several jurisdictions have already benefited from using the National ITS Architecture. You can start right now by thinking about your transportation system from an architecture perspective by:

- Finding out if your current and planned equipment is capable of "talking" to other systems.
- Understanding your community's communications backbone and determining if there are options for shared investments.
- Finding out if your databases can be read by other agencies and if you can read theirs.
- Becoming a catalyst for getting the right players together.
- Training your workforce.
- Considering an evolutionary path to implementation.

Continued on next page

Background: The National ITS Architecture, Continued

For more help

We can help you understand your alternatives and plan for a smarter future. For more information on how to get started, please contact your local Federal Transit Administration or Federal Highway Administration field representative. At the national level, contact:

U.S. Department of Transportation
ITS Joint Program Office
Room 3422, HVH-1
400 7th Street, SW
Washington, DC 20590
(202) 366-9536

Or visit our web site at *www.its.dot.gov*

Background on Terminology: "Planning"

Purpose

- The use of the word "planning": In previous Professional Capacity Building courses and seminars, the introduction of "planning" material has led to controversy and sometimes invoked heated discussions. The problem is that planning can mean different things to different people.

Context of regional planning

First, the term "planning" can be used within the context of regional planning.

- This is done by the local MPO or Statewide Agency and is comprehensive to the transportation issues/problems of a region. It usually covers a long-term horizon of about twenty years.
- The products of these planning efforts include a Transportation Plan and a Transportation Improvement Plan (TIP) of funded projects. The TIP defines projects to be implemented in a region and identifies the funds to do so. Both of these Plans are reviewed and updated on a regular basis.
- It is not currently being done by many MPOs but it is recommended that an ITS Plan be developed that provides a regional framework for ITS project implementation.
- Many MPOs have developed Early Deployment Plans (EDPs) that address some of these ITS implementation issues.
- ITS has also been addressed by some MPOs in other planning activities such as Congestion Management System (CMS) plans.

Within transit organizations

Secondly, planning is done within a transit organization to improve service and operations. Routes are reviewed, ridership ascertained, and other demographic information is studied to determine the optimal service levels and operations capabilities available within the given resources of the Agency. ITS projects can improve the productivity of these operations and thus assist the development of the strongest, most efficient service plans. ITS hardware and software infrastructure can also provide data to service planners.

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Background on Terminology: "Planning", Continued

Technical project level

Finally, planning is done at the technical project implementation level. This is mainly what the material in the course represents. The projects being planned in this phase have already been identified in the earlier planning phase in the TIP. This type of planning involves identifying needs, requirements, and resources; project definition; cost estimation; and other project planning activities. It leads to and is followed by activities concerning technical design (systems engineering), procurement strategies and other implementation considerations. There is significant overlap and interrelationship between these three planning levels.

Overlap

Because of these significant areas of overlap in the different uses of the term, it is important to make sure the instructor clarifies that, for this course, the material presented only addresses the limited planning function involved in project implementation.

This overlap is, in part, the source of confusion of the terms. A description of the overlap would be that an individual project is identified in the TIP to meet regional requirements. Those requirements would somehow be addressed in the individual project needs and requirements and the project definition following its inclusion in the TIP. In addition, the project would function in support of operations and service level strategies outlined in the agency's service planning strategies. Following implementation the project might also provide useful data to the Agency's planners in their continued efforts in service planning. Another example of overlap would be that technical project specifications should be consistent with the regional ITS framework. The regional ITS framework would be a product of the high level MPO planning process. Later it would become the template for specific ITS projects to develop around.

For more help

Office of Planning/Operations
FTA, TPL-10

Background on Standards

Background information

The following information is from the one-day ITS in Transit Seminar.

Current status

In November 1996, the USDOT Joint Program Office (JPO) for ITS selected the Institute of Transportation Engineers (ITE) as the Standards Development Organization (SDO) responsible for the development of the TCIP.

Since that time, substantial and significant progress has been made. The SDO released Draft standards on Sept. 2, 1997, which were out for review through Feb. 1998. Based on the comments received, the TCIP has generated extensive interest in the transit community. Final TCIP Standards were published mid-1998.

In addition, the TCIP draft standards have been accepted for inclusion within the National Transportation Communications Interface Protocol (NTCIP), the standards that set out all physical and data links in transportation.

Continued on next page

Background on Standards, Continued

Critical Standards

Additionally, the Department of Transportation is developing a list of seventeen technical standards that are critical for achieving national interoperability of ITS. To read more about the standards, access the web site *http://www.its.dot.gov/standard/critdoc.html* and examine the *1999 DOT Report to Congress on Critical Standards*.

Other standards

The table below lists some Standards Development Organizations (SDO) and the standards they are developing.

Transit Related Standards		
Activity	**Description**	**SDO**
NTCIP: National Transportation Communications Interface Protocol	Physical and data link protocols	AASHTO
TCIP: Transit Communication Interface Profiles	Physical, data link and application layer standards for the Transit Management Center and vehicles	ITE
In-Vehicle Databus Interface	Plug-and-play integration of multiple ITS electronics in vehicle	SAE
Location Reference Specs	Preliminary draft standard	SAE
Automatic Vehicle ID	Messages used to report vehicle ID	IEEE
Message Set for external TMC Communication	Application messages transfers between TMCs and other ITC centers	ITE
SURVEY: Communications, Technologies, Practices, and standards relevant to ITS	Applicable standards to ITS short range and wide area wireless and wireline communications	IEEE

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Background on Standards, Continued

Transit related standards

The results from the TCIP Working Group will be the definition of Physical data links and application layer standards for the Transit Management Center (TMC) and vehicle and between the TMS, vehicle and other centers.

There are other standards for specific APTS technologies and services underway that should likewise be of special interest to transit industry officials.

- The first is the NTCIP, of which TCIP is a subset. Led by AASHTO, the NTCIP will develop Physical and data link protocols and application specific object sets.
- The Society of Automotive Engineers (SAE) is leading the development of the in-vehicle database interface standards which will permit plug-and-play integration of multiple ITS electronic devices into a vehicle while ensuring the safety and integrity of the vehicle and on-board systems are maintained. The 1994 standard for bus vehicle area networks, known as SAEJ1708, was one of the first ITS standards developed.
- SAE is also evaluating preliminary location reference specification in a test and will modify it as necessary into draft standards.
- The Institute of Electrical and Electronics Engineers (IEEE) is developing automatic vehicle identification standards that will define the messages used to report vehicle identification.
- ITE is defining the application messages transferred between TMCs and other ITS centers, including transit dispatch/operations centers, under the external TMC communication activity.
- Finally, although it is not a specific standard, the IEEE survey cuts across and supports multiple standards development activities.

Other Related Background

Physical and Technical Project Definition		
Project Definition	**Includes…**	**For example…**
Physical project definition	• location of all components of the project	◊ passenger terminals ◊ service/storage facilities ◊ routes/track ◊ control center ◊ intermodal links
	• layout of each of the facilities	
	• requirements for specific facilities	◊ passenger/employee ◊ service/storage ◊ control
	• interfacing/interoperability with planned and existing systems	◊ terminals ◊ access ramps ◊ ticketing facilities/procedures ◊ vehicle design modifications ◊ traffic control elements (lights, signs, highway monitors)
	• configuration of the proposed passenger vehicle	◊ to accommodate provisions of ADA ◊ to promote efficient traffic control ◊ to accommodate advanced transit control applications
Technical project definition	• design/construction specifications of vehicles, facilities, and systems	
	• maintainability of software and systems	
	• system operations and characteristics	
	• system architecture	◊ software protocols and compatibility for the future ◊ coordinating the interface/ interoperability with existing systems ◊ addition/implementation of new systems (expansion compatibility)

Other Related Background, Continued

Federal funds - legal authority

The public agency responsible for any transit capital development project must:

- possess the legal authority to carry out the following:
  - ◊ plan, design, construct, own, operate, and maintain public transit facilities
  - ◊ perform local financing, such as use of public funds, taxation, and issuing bonds
  - ◊ receive federal and state grants
  - ◊ procure and award contracts
  - ◊ acquire and condemn real estate

- recognize the difficulties with FTA grants for ITS projects, like others:
  - ◊ have no operating and maintenance monies
  - ◊ often have unreasonable time tables

Flexible funding

The Intermodal Surface Transportation Efficiency Act (ISTEA) of 1991 authorized states to transfer funds between highway and transit program accounts. Over two billion dollars of highway funds have been transferred to transit since that Act was passed.

Formula funding

FTA can also fund programs based on population. There are three primary formula funded FTA programs that were formerly referred to as Sections 9, Section 16, and Section 18. Those programs are now identified as:

- 49 U.S.C. 5307
- 49 U.S.C. 5310
- 49 U.S.C. 5311

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Other Related Background, Continued

Procurement principles

Three general ethical principles are basic to all federal contracts and are supported by a variety of rules and regulations at every government level.

Principle	Description
Minimum needs doctrine	• Use public funds for purchase of essential items only. • In other words, buy only what you minimally need, not what you would like to have. ◊ "tried and true" vs. "cutting edge"
Avoid conflicts of interest	Avoid conflicts of interest by anticipating the potential for conflicts and structuring the procedures accordingly. • The procurement process should be conducted in a manner which prevents any contractor from gaining an unfair competitive advantage from: ◊ prior work done ◊ future interests of the contractor ◊ other work or service being provided by the contractor concurrently ◊ personal or professional relationship between purchaser and contractor
Full and open competition	• The goal is to obtain the best quality and best service at minimum cost. • Encourage meaningful interest and offers from all entities. • Rule out bids only for business reasons: ◊ cost ◊ quality ◊ delivery • Maintain records and documentation, listing: ◊ sources solicited ◊ cost estimates ◊ copies of published notices ◊ abstracts of offers ◊ source selection documentation ◊ determination that price is fair and reasonable ◊ records of internal approvals ◊ notice of award ◊ notices to unsuccessful bidders ◊ record of any protest ◊ insurance documents

Continued on next page

Other Related Background, Continued

Standard procurement methods

The following table contains information from FTA Circular 4220.1D, which defines Third Party Contracting Requirements, and establishes six standard methods of procurement.

Method	Description
Micro-purchases	• Micro-Purchases are purchased in amounts under $2500: ◊ may be made without competitive quotation if the grantee determines that the price is fair and reasonable ◊ are exempt from Buy-America requirements ◊ should be distributed equitably among qualified suppliers ◊ require Davis-Bacon Act (minimum wage) consideration for construction contracts between $2000 and $2500 ◊ May NOT be used if splitting of procurement is involved. In other words, you can't split a $4,000 contract into two separate contracts just to avoid competitive bidding.
Small purchases	• Small purchases are purchases in amounts greater than $2500 but less than $100,000: ◊ require price or rate quotations from an adequate number of qualified sources
Sealed bids	• Occur under the following conditions: ◊ a complete, adequate, and realistic specification or purchase description is available ◊ two or more bidders are able to compete effectively for the business ◊ the procurement lends itself to a fixed price contract ◊ the selection of the winner can be made principally on the basis of price ◊ no discussion with bidders is needed • Require: ◊ public solicitation of bids with adequate time allocated for suppliers to prepare offers ◊ an invitation which clearly defines the items or services sought ◊ bids to be opened publicly at a prescribed time and place • A fixed-price contract should be awarded to the lowest responsive and responsible bidder. ◊ Any or all bids can be rejected for a sound, documented business reason.

Continued on next page

Other Related Background, Continued

Method	Description
Request for Proposal	• Used when sealed bids are not appropriate, such as when the price of a service is not the major consideration of the project. (For example, a project might cost more, but be completed earlier.) • Require that: ◊ the RFP (request for proposal) be publicized and contain all evaluation factors along with their relative importance ◊ proposals be solicited from an adequate number of qualified sources ◊ a procedure be in place to conduct technical evaluations of the proposals and to select awardees ◊ awards be made to the responsible firm whose proposal is most advantageous to the grantee's program with price and other factors considered
Architectural & engineering	• Applicable for architectural and engineering services and also: ◊ program management ◊ construction management ◊ feasibility studies ◊ preliminary engineering, design, surveying, mapping, and services which require performance by a registered or licensed architect or engineer • Uses procedures based on the Brooks Act, which requires: ◊ a bidder's qualifications be evaluated ◊ price be excluded as an evaluation factor ◊ negotiations be conducted with only the most qualified bidder ◊ failing agreement on price, negotiations with next most qualified bidder be initiated until a fair and reasonable contract is made
Non-competitive proposals	• May be used when award of a small purchase, sealed bid, or competitive contract is not feasible and at least one of the following circumstances also applies: ◊ the item or service is available from only one source ◊ an emergency condition does not permit the time delay caused by other competitive bidding processes ◊ FTA authorizes noncompetitive negotiations ◊ after solicitation of a number of sources, the sole source's competition is determined to be inadequate ◊ the item is an associated capital maintenance item which is procured directly from the original manufacturer of the item to be replaced ◊ requires a cost analysis

Continued on next page

Other Related Background, Continued

Method	Description
Traditional Design-bid-build considerations	• Technology has forced modifications in the bidding and contracting process. • You can no longer build and then plan for maintenance – you need to consider ongoing use and maintenance at the same time. • Consider keeping contractors involved longer than on traditional projects, since the contractor is usually the one who has the technical expertise. ◊ Contractor involvement can help the transition to the operations phase go more smoothly.
Design- build	This method can overcome the problems of the traditional approaches: • The public agency defines the end parameters and establishes the design criteria for a project. • The public agency contracts out the work. In a single contract: • All work is handled under one contract. • The designer/builder is responsible for the details of design, procurement, construction, integration, and operational start-up. • The operations are then turned over to the operating agency. • This allows the designer/builder the maximum flexibility for innovation and allows the contractor choices as to the best way to get the job done. ◊ Be sure to consider how integration and testing issues will be handled. • This method puts more responsibility on the contractor. • Combining design-build speeds the process of deployment from the contractor's perspective. ◊ Construction can often begin before all design details are finalized. ◊ No delays due to design error or changes are allowed because the designer and the builder are the same party. • Design-build also can work with multiple contracts and the agency acting as the overseer of all the parts. *Note: The Design-Build Institute of America reports that:* • *27 states permit design-build, but 9 states specifically prohibit design-build*
BOT: Build-operate-transfer	A private firm designs and builds the project without public financing. • The private firm operates the project for a set period of time, during which they may recover their costs. • The private firm transfers ownership to the public agency.
BTO: Build-transfer-operate	A private firm designs and builds the project. • Ownership immediately passes to the public agency. • The public agency contracts with the private firm to operate the project for a set period of time, during which they may recover their costs.
BOO: Build-own-operate	A private firm designs, builds and operates the project w/o public financing. • No transfer of ownership occurs.

Other Related Background, Continued

Procurement Control

The following table compares two forms of control for procurement:
- Centralized
- Decentralized

Decentralized	Centralized
• Decentralized control employs several sources that make decisions on matters pertaining to individual areas. ◊ efficient for large projects, since separate decisions can be made as needed for the project to proceed ◊ On occasion, diffusion of the decision making process makes it difficult to monitor, creating the possibility of corrupt decision making. ◊ different sources may make inconsistent decisions ◊ confusing and disorderly if used on a small project	• Centralized control requires a single source that makes all financial decisions. ◊ efficient for small projects where there are a limited number of expenditures ◊ consistent in that the same individual makes the decisions ◊ easy to monitor since decisions are easily traced ◊ inefficient for large projects, which require numerous decisions

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Other Related Background, Continued

Alternate Funding Sources

Local funds for transit development can be raised from various sources. The following table shows what some states have done in the past.

How	What	Who
Assessments	• Transit Assessment District	Denver, Colorado
	• Special Benefit Assessment Districts	Los Angeles and Miami
Fees	• Transit Impact Fee	San Francisco, California
Negotiated investments	• Development Bonuses	New York City, New York
	• System Interface Program	Washington, DC
	• Transfer Center Investment	Portland, Oregon
Private donations, initiatives, development	• Merchant Subsidy	Cedar Rapids, Iowa
	• Bus Shelter Development	St. Louis, Missouri
	• Negotiated Land Leases	Tacoma, Washington
	• Privately Financed People Movers	Tampa, Florida
	• Contracted Bus Service and Maintenance	Johnson County, Texas
Taxes	• State Sales Tax and Sales Tax on Fuel	California
	• Motor Vehicle Excise Tax	Washington
	• Sales Tax	Maricopa County, Arizona
	• Beer Tax	Birmingham, Alabama
	• Payroll Tax	Portland, Oregon
	• Lottery	Pennsylvania

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Other Related Background, Continued

GIS national system

The national transit Geographic Information Systems initiative promotes coordination from the top as well as with other government agencies at the same level, such as:

- highway
- regional/city planning
- police
- fire
- other transit agencies

For an integrated ITS system, a common GIS must be in place.

The Transit GIS

Through a collaborative effort, the FTA is creating a National Transit Geographic Information System (GIS), which is a representative inventory of the public transit assets of the country. Besides inventory, it will include:

- geographic information
- maps
- population information

- For more information, contact:
  - ◊ FTA Office of Research, Demonstration and Automation
    400 7th Street SW
    Washington, DC 205090
    (202) 366-4991